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COGNITIVE CHARACTERISTICS AS
PREDICTORS OF CHILDREN'S
UNDERSTANDING OF SAFETY AND
ACCIDENT PREVENTION (REFLECTION-
IMPULSIVITY, CAUSAL REASONING,
PARENT STYLE)

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UNDERSTANDING OF SAFETY AND ACCIDENT PREVENTION

University of New Hampshire

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COGNITIVE CHARACTERISTICS AS PREDICTORS OF CHILDREN'S
UNDERSTANDING OF SAFETY AND ACCIDENT PREVENTION

BY

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A DISSERTATION

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ABSTRACT

COGNITIVE CHARACTERISTICS AS PREDICTORS OF CHILDREN'S UNDERSTANDING OF SAFETY AND ACCIDENT PREVENTION

by

Nina M. Coppens
University of New Hampshire, May, 1985

In the present study, children's level of causal reasoning and cognitive style were considered as possible predictors of their understanding of safety and accident prevention. Understanding of safety and accident prevention were operationalized as differentiation of safe and unsafe situations and specification of measures for preventing accidents, respectively. Individual interviews were conducted with 112 children, aged 3 through 8 years, currently enrolled in either a daycare or after-school program.

An accurate understanding of safety and accident prevention was related to an understanding of causal relations and to a reflective cognitive style. However, multiple regression analyses revealed that level of causal reasoning eliminated cognitive style as a significant predictor of children's safety and prevention scores. The correlations and regressions for 3 to 5 year olds and 6 to 8 year olds were examined separately for age-related differences. The variability in the younger group's performance on the predictor measures explained more of the variance in their safety and prevention scores compared to the older children's performance. These differences are discussed in terms of the children's stage of development and the higher national rate of accidents among preschoolers compared to school-age children. Examination of children's safety and prevention scores also indicated

that the ability to differentiate between safe and unsafe situations occurred prior to the ability to specify preventive measures. Implications of the results for safety education programs are discussed.

Parents' style of responding to children in unsafe, hypothetical situations and their beliefs concerning determinants of children's development were examined in an exploratory manner. Different styles were represented in parents' responses to children, with many parents using no style consistently across unsafe situations. There were no significant relations evident between parents' response styles or beliefs concerning development and children's safety and prevention scores.

Measurement issues and directions for future research concerning the child and parental variables are presented. Suggestions include a longitudinal investigation of children's frequency of accidents, cognitive characteristics, concepts of safety and prevention, and interactions with significant others to clarify the relations among these variables.

I. INTRODUCTION

Accidents are a major cause of children's hospitalization, disabilities, and death (International Children's Centre, 1979). It is therefore important to understand the characteristics of children which might contribute to their accident proneness. This should provide direction for recognizing children at risk and for taking measures appropriate to prevent accidents.

Historically, research related to children's accidents was conducted within a psychoanalytic framework. This research assumed that an explosive, assertive, and disagreeable child (Fuller, 1948) who grew up in a strict home environment with feelings of rejection would become involved in accidents as a result of aggression turned inward (Krall, 1953). In a 1960 issue of Monographs of the Society for Research in Child Development devoted to research related to accident patterns in children (Marcus et al., 1960), accident repeaters were viewed as maladjusted in that their defense mechanisms failed to adapt adequately to a transient or chronic life stress situation. Manheimer and Mellinger (1967) expressed the doubt that children's accidents originate in neurotic conflict or a single personality type. However their results, based on retrospective parent and teacher reports, revealed characteristics of the child accident repeater similar to those reported by previous researchers (i.e., aggressiveness and motivation that compete with the desire to avoid accidents).

These early researchers viewed the characteristics of accident prone children as personality traits that persist over time; however,

this view fails to explain age-related differences which appear in frequency of accidents. Meyer, Roelofs, Bluestone, and Redmond's (1963) research focused on preschool children because of the high rate of accidents in this age group. The authors suggested that this elevated accident rate was due to developmental limitations in preschoolers' abilities to cope with stress. No significant differences were found between the injured children and their same age noninjured peers in social or disciplinary characteristics. However, neither cognitive characteristics of the preschoolers nor developmental differences between preschoolers and an older age group were considered as explanations for the younger group's higher risk for accidents. Matheny, Brown, and Wilson's (1971) longitudinal study of 1 to 6 year old same sex twins revealed differences between twins in accident proneness. Mothers reported that the more active, temperamental, and inattentive twin was more likely to have accidents. Although the total number of the children's accidents declined as age increased, no explanation was given for this decline in number of accidents. If the accidents were due to stable personality traits, then such a decline would not be expected.

Compared to school-age children, preschoolers have a higher rate of accidents (International Children's Centre, 1979). In attempting to discover the reasons for this age-related difference in proneness to accidents, consideration of other differences between these two age groups may be helpful. Ruuhilehto-Saari (1982) has emphasized the need to consider the possibility that all children pass through stages of being more accident prone rather than to focus on stable individual differences in accident proneness. Differences in motor coordination

and/or cognitive capabilities may be related to the relative degree of vulnerability to accidents found in children at different stages of development. It might be expected, for example, that because younger children are less well coordinated than older children that poor motor coordination might contribute to a high rate of accidents. However, in an examination of this hypothesis, Langley, Silva, and Williams (1980) found no relationship (of practical significance) between children's motor coordination and their history of accidents.

A major difference between preschool and school-aged children, as described by Piaget (1960), is in their manner of processing and using information provided in the environment. One important difference between these two age groups is their understanding of causal relationships. This is important because in the majority of accidents involving children, a causal agent can be identified (e.g., fire causes burns) (International Children's Centre, 1979). Thus, children's ability to engage in causal reasoning may be related to their understanding of the concepts of safety and accident prevention. Children with an accurate understanding of these concepts may use this information both to avoid unsafe situations and perhaps also to prevent accidents. Along similar lines, a significant positive relationship was found between 5, 7, and 9 year olds' conceptions of illness and health and their performance on a physical causality task, even after controlling for the effect of chronological age (Simeonsson, Buckley, & Monson, 1979). In terms specific to safety issues, Faber and Ward (1977) suggested that a relationship may exist between the age-related differences they found in children's understanding of using products safely and children's ability to see cause and effect relationships.

Furthermore, the ability to assess the safeness of a situation may also be affected by the cognitive style of the individual, in as much as cognitive style may reflect attentiveness to multiple features of a stimulus array. Based on a series of studies of children performing cognitive tasks, Kagan, Rosman, Day, Albert, and Phillips (1964) proposed a cognitive style continuum referred to as reflection-impulsivity. In comparison to reflective children, impulsive children responded more quickly and with more errors on cognitive tasks. Therefore by definition, an impulsive individual's assessment of a situation is likely to be little more than superficial or cursory. In contrast, a reflective person is more likely to take the time to carefully consider more of the features that make up a situation and thus, may be more likely than the impulsive person to identify a potential accident before it happens.

In the sections that follow, causal reasoning, cognitive style, and parental factors will be considered in general and in terms of how each may relate to the childhood accident phenomena.

Causal Reasoning

According to Piaget (1960), preschool children lack strategies for acquiring knowledge systematically and they lack an underlying system for organizing the knowledge they do acquire logically. Causal judgments for children at this stage are phenomenistic (i.e., no relation exists between two factors except that of closeness in time and space). As a result, young children's judgments about the relations among events are often inconsistent and this inconsistency is either not noticed or, at least, not questioned by the children. Similarly, any evidence that contradicts the children's judgments is not questioned

because the children are not searching for mechanical causes of events nor are they yet considering general rules governing certain types of events. Explanations preschoolers give for their causal connections are often magical, moral, artificialistic, and/or animistic. Piaget (1960) observed that only when children reached school age did they have the ability to predict and to explain logically cause and effect sequences. This ability apparently depends upon children's ability first to identify causal agents and their consequences, and second to realize that they are not necessarily spatially and/or temporally contiguous.

Recent research (e.g., Gelman, Bullock & Meck, 1980; Shultz & Mendelson, 1975) testing Piagetian notions concerning children's understanding of causality and using measures simpler than those employed by Piaget (1960) and his associates, has indicated that children as young as three years of age have the ability to make relevant causal connections. [Although differences between Piaget's (1960) work and the recent research in terms of age of acquisition of causal reasoning in children has been taken as evidence of flaws in Piaget's theory, it could as easily be seen as a reflection of the influence this theory has had on the environment provided preschool children.] Even though the more recent research found that preschoolers were able to make causal connections, limitations were found in the children's reasoning abilities. Various measures for determining level of causal reasoning and limitations in children's performance on these tasks are presented in what follows.

In Brown and French's (1976) study, children between 5 and 10 years of age were required to order temporally four sets of pictures which were presented simultaneously. For half the sets, children were asked

to identify the consequence (last picture) in the sequence and for the other half to identify the cause (first picture). Kindergarten children were more successful at finding the last picture in the sequence than in finding the first, while second and fourth graders performed equally well when finding either causes or consequences. However, when testing preschoolers (mean age 5 years, 1 month), Sharp (1982) found the picture sequencing task employed by Brown and French to be too difficult. It was necessary to eliminate the competing picture sequences and to present each set one at a time before the children could order the events depicted in the pictures temporally. Similarly, the kindergarteners in Siegler's (1975) experiment were able to identify reliably an effect from a cause with which it covaried only after distracting influences were removed. Although it is the case that in real life it is not always possible to remove distracting, irrelevant variables from a child's environment, these studies do suggest that young children can identify causal agents and consequences when simple sequences are presented and irrelevant information is kept to a minimum. In an investigation of children's understanding of the effect of causal factors on consequent events, Shultz and Mendelson (1975) also found limitations in children's reasoning. Three to 7 year olds had greater success at identifying covarying factors that caused (facilitated) a consequence than identifying covarying factors that prevented (inhibited) a consequence from occurring.

The developmental limitations in children's causal reasoning identified in the previously cited studies reflect the attainment of an understanding of causality offered by Kassin (1981). Kassin suggested causal reasoning is governed by three increasingly complex principles:

(a) temporal and spatial contiguity (i.e., cause and effect coincide in time); (b) covariation (the consistency with which events co-occur); and (c) predictions being based on facilitating and inhibiting factors. He postulated that young children's reliance on temporal and spatial contiguity may dominate and precede their use of higher order principles. This makes sense from a strictly Piagetian perspective in that temporal and spatial contiguity are perceptually salient while the other principles are more conceptual.

Translating all this into accident-related issues, preschoolers may be able to make the causal connections necessary to identify accident agents and their consequences. Yet children in this age group may have difficulty understanding how to keep a consequence from occurring (i.e., identify a cause from a consequence and inhibit the facilitating factor). Thus one would expect that children's scores on measures evaluating their ability to differentiate between safe and unsafe situations would be fairly high, but that their ability to specify measures for preventing or inhibiting unsafe situations would be comparatively low. In a previous investigation of preschoolers' understanding of safety and prevention concepts, the children scored significantly higher on the safety compared to the prevention task (Coppens, 1985). Results from this earlier work also indicated that even after controlling for the effect of age, level of causal reasoning was found to be a significant predictor of preschoolers' performance on the criterion measures of safety and prevention. Although level of causal reasoning predicted both safety and prevention scores, it explained more of the variance in the safety measure. This suggested that children's ability to identify safe and unsafe situations and their

ability to specify preventive measures may be dependent on different aspects of causal reasoning.

Cognitive Style

The degree to which children systematically scan the environment and consider alternative hypotheses in solving problems may also be predictive of their understanding of safety and prevention. The cognitive style dimension of reflection-impulsivity might be relevant in this context. Reflection was initially conceptualized as the consideration of alternative hypotheses when many are available simultaneously (Kagan et al., 1964). Kagan and Kogan (1970) clarified this dimension as one concerned with the degree to which the child reflects on the validity of his/her solution hypothesis in problems that contain response uncertainty. The most common operational definition (Messer, 1976) includes latency to first response, and accuracy of choice or total errors on the Matching Familiar Figures Test (Kagan et al., 1964).

Research has indicated the existence of a relationship between cognitive style and the search strategies children use to perform problem solving tasks (Drake, 1970; Kagan, Pearson, & Welch, 1966; Siegelman, 1969). Problem solving strategies, inferred from scanning patterns, have been examined by recording children's visual fixations as they perform on the Matching Familiar Figures Test (MFFT). These studies revealed that reflectives systematically gather more information about the stimuli before offering an answer than do impulsives. The reflective first grade children in the study by Kagan et al. (1966) looked more frequently at the standard and variants than the impulsive children. Thus impulsive children may produce and test fewer hypotheses

than reflectives.

Children's tendency to be reflective or impulsive has also been shown to be predictive of their performance on other tasks which involve scanning and analysis of a visual field. On these tasks, reflectives perform consistently better than impulsives (Duryea & Glover, 1982; Kagan et al., 1966; Kogan, 1976; Messer, 1976). Impulsive first graders had faster response times and higher error scores on inductive reasoning tasks which involved responding on the basis of self generated alternatives as well as selecting from a choice of alternatives (Kagan et al., 1966). Children's degree of reflection-impulsivity may relate to their scanning the environment systematically for critical features to discriminate whether a situation is safe or unsafe and to generate alternatives for preventing the unsafe situations.

Studies which have reported results only in terms of differences between reflective or impulsive subjects based on double-median splits of MFFT latency and errors are difficult to interpret. Unfortunately much of the research on reflection-impulsivity has not examined the separate contribution of latency and errors as predictors of performance (Messer, 1976). Researchers who have examined them separately have indicated that number of errors was better than latency for predicting children's problem solving ability and academic achievement (Egeland, Bielke, & Kendall, 1980; Haskins & McKinney, 1976).

From a developmental perspective, research findings suggest that cognitive style in problem solving becomes more stable with age and children become increasingly more reflective (Ault, 1973; Messer, 1976). For school-age children, the negative correlation between latency to first response and errors tended to become larger with age (i.e., with

an increase in response time there occurred a decrease in errors) (Ault, 1973). In Ward's (1968) preschool sample, a significant negative correlation between response time and errors was absent at 4 years 3 months but present at 5 years 11 months in boys and present even earlier in girls at 4 years 11 months. During the preschool years, response time and errors may be independent of each other. Messer (1976) suggested that preschoolers' delay in solving a problem may be due to a lack of understanding the task rather than using the delay to consider alternative hypotheses. Thus for younger children, it may be that only error rate on the MFFT is predictive of their safety and prevention scores, while for school age children both error rate and latency to first response may be predictive.

In a six month longitudinal study, 3 to 6 year olds' cognitive development, indicated by mental age, covaried with cognitive style (Achenbach & Wiesz, 1975). During the preschool years, the reflection-impulsivity dimension may be in an elementary form that emerges with cognitive development. Therefore, the influence cognitive style has on children's understanding of safety and prevention may vary with children's level of causal reasoning. Although Coppens (1985) identified age and level of causal reasoning as significant predictors of preschoolers' understanding of safety and prevention, much of the variability in the criterion measures was not accounted for by these predictors (i.e., 59% of the variability in safety scores and 76% of the variability in prevention scores). In addition to level of causal reasoning, if children's cognitive style had been considered as a predictor a larger portion of the variability in children's safety and accident prevention scores may have been explained.

Parental Factors

In an early examination of child rearing patterns, Sears, Maccoby, and Levin (1957) noted that differences in children's age were related to mothers' degree of control in dealing with safety issues. The authors suggested the preferred role for mothers is to protect children younger than three years and as children grow older to teach them to avoid dangerous situations by creating rules. Researchers have identified some parental characteristics which appear to differentiate "accident prone" from "non accident prone" children. For example, emotional disturbance (Marcus et al., 1960), unsafe behaviors (Holden, 1979), frequent use of discipline (Langley, McGee, Silva, & Williams, 1983), and high levels of life stress (Meyer et al., 1963) were more common among parents who had children experiencing frequent accidents. However, because these parental characteristics were measured after children's accidents, they could be viewed as either contributors of the accident, parents' selective memory, or a result of the accident itself. Although these researchers described their studies as investigations of parental characteristics, in fact only mothers were commonly interviewed. Faber and Ward (1977) interviewed 5, 8, and 11 year olds and their mothers concerning the children's understanding of product safety. The majority of children identified their mothers as the primary source of their information concerning product safety. Even though fathers were not considered as a direct influence by the investigators, some children identified fathers, and not mothers, as an important source of their information.

Fathers, as well as mothers, have been recognized as having an influence on children's social competence and psychological development

(Earls, 1976; Lamb, 1981, 1975). However, the role parents adopt has typically been viewed as different for mothers and fathers. The mothers and fathers in Lytton's (1980) sample differed in their style of redirecting children's changeworthy behavior. Mothers provided significantly more rational explanations and justifications for their orders than fathers did. While the average relative frequency of physical punishment was slightly higher for fathers than mothers, more fathers than mothers did not employ physical punishment at all. Lytton's review also indicated that fathers were more likely than mothers to change children's ongoing behavior. The reason given for this difference in mothers' and fathers' effectiveness in changing children's behavior was that fathers spend less time with their children, thus providing in absolute terms fewer directions than mothers. Thereby fathers' requests produce a novelty effect which result in greater attention on the part of the child.

Lamb (1981) has suggested that the shift in the increased number of mothers working outside the home has contributed to fathers taking a more active role in their children's care, compared to the traditional role taken by fathers. Research in the area of parent-child interactions has indicated that parents' style of responding to children was related to the influence they have on children's behavior (Holden, 1983; Johnson & McGillicuddy-Delisi, 1983; Masur, 1982). Masur's (1982) examination of parents' speech to their preschool age children during play sessions, as well as Holden's (1983) examination of mothers' responses to their child's eliciting behavior while shopping in a supermarket identified many categories of parental response style (e.g., reasoning, verbal commands, and physical controls). Although both of

these studies focused on the preschool age group, it is expected that the categories of parents' responses could also extend to older age groups. However, the use of a particular category and the effect that response style has on children's behavior may vary with children's age and the type of situation. Children's involvement in unsafe situations is viewed by this researcher as changeworthy behavior. It is possible a relationship exists between parents' style of responding to children who are in unsafe situations and their children's understanding the concepts of safety and accident prevention.

Sameroff and Feil (1981) have argued for the need to assess the underlying theories parents hold concerning determinants of children's development and the influence these theories may have on parent-child interactions. Parents' response styles may evolve from or exist in parallel to their belief concerning the source of children's development. In McGillicuddy-DeLisi's (1982) observations of parents' interactions with their preschool children, the teaching strategies focused on were those that stimulated the child to anticipate, reconstruct, and think in representational terms on predetermined tasks. It was believed that use of this strategy would be related to parents' view of children as active processors who construct their own reality. This relationship existed between fathers', but not mothers', beliefs and teaching practices. Parents' beliefs concerning determinants of children's development might contribute to the type of information they provide children on safety issues and thus have an influence on children's understanding of safety and prevention.

The present study was designed to examine relations between the following variables: parents' response style and their beliefs

concerning children's development and children's cognitive style, level of causal reasoning, differentiation of safe and unsafe situations, and specification of preventive measures; the latter two variables were considered as criteria and the former four variables as predictors. Safe situations were defined as those in which no identifiable accident causing agents were present, or those in which the potential for an accident had been reduced as a result of precautions taken by the actor. Unsafe situations were those in which the cause of a potential accident could be identified and its consequences or effects could be prevented.

This study, a follow up of earlier research (Coppens, 1985), included school-age as well as preschool children. This extension of age range was included to increase the variability among scores and provide a better indication of developmental changes in children's performance. The inclusion of both age groups enables a comparison between preschoolers' and school-age children's responses which may help explain why preschoolers are relatively more accident prone. Additional measures of causal reasoning were incorporated in the present study for two reasons. First, the results of the earlier study raised questions about what features of causal reasoning were most predictive of children's performance on the safety and prevention tasks. Second, differences in measures used by other researchers' (e.g., temporal sequencing and covarying factors) indicated that causal reasoning may be multifaceted. The multiple measures of causal reasoning provide for an examination of the possible differential contribution of components of causal reasoning. Cognitive style was added as a possible predictor of preschoolers' and school-age children's understanding of safety and accident prevention. Because children's delay and their accuracy on the

Matching Familiar Figures Test (MFFT) may be independent predictors of performance, they were examined as separate components of children's cognitive style.

Parental variables were included because of the general agreement that parents are an important part of a child's early learning environment, providing models for appropriate behavior as well as providing children with specific information about their environment. Mothers' and fathers' response styles and their beliefs of heredity and/or environment as determinants of children's development were investigated in an exploratory manner. Parents' response style referred to parents' report of their responses to children in five unsafe, hypothetical situations. Due to the exploratory nature of the parental measures, no a priori predictions were made. The following research questions were addressed:

1. Do differences exist in parents' style of responding to children in unsafe situations?
2. Do parents consistently respond with the same style to different unsafe situations?
3. Is there a relationship between parents' style of responding to children in unsafe situations and children's understanding of safety and prevention?
4. Is there a relationship between parents' belief concerning determinants of development and children's understanding of safety and prevention?

In summary, no hypotheses were made concerning the predictive nature of the parent measures. In reference to the child predictor variables, the following hypotheses were tested:

1. Children will be able to differentiate between safe and unsafe situations before they are able to specify preventive measures.
2. A positive correlation will exist between children's causal reasoning scores and their safety and prevention scores.
3. A positive correlation will exist between children's response time on the MFFT and their safety and prevention scores.
4. A negative correlation will exist between children's error score on the MFFT and their safety and prevention scores.

II. METHOD

Subject Selection

A written description of the study and the consent form were sent to all parents of children between the ages of 6 and 8 years currently enrolled in an after-school program (sponsored by a New Hampshire city) (See Appendix A for the parent letter and Appendix B for the consent form). Parents were instructed to return the consent form to a box marked "safety study" located next to the signout sheet at their child's after-school program. Parents of 52 out of 67 school-age children (78%) agreed that they and their child would participate in the study. If two parents were present in the home, both were encouraged to participate.

This same method for selecting children was used for children aged 3 years and older currently enrolled in a preschool daycare center in the same city. Parents of 29 out of 34 children (85%) agreed to participate. Two additional preschool daycare programs were sampled selectively for the ages needed to obtain a fairly equal representation of children at each age from 3 through 8 years (five of the 6-year-olds were in the last month of their kindergarten program). Parents of 31 children from the two preschool programs agreed to participate. This indicated an agreement rate of 70% and 63%. This lower agreement rate for the two additional programs may have resulted from the sampling occurring near the end of the school year.

Oral assent was obtained from children prior to their being interviewed. None of the children refused to participate. Prior to contacting parents, approval for this study was received from the

University of New Hampshire's Institutional Review Board as well as from the directors at the children's daycare and after-school programs.

Subjects

The 112 children studied included 60 girls and 52 boys. The number of children at each age from 3 through 8 years was 19, 18, 18, 19, 20, and 18, respectively. The children ranged in age from 38 to 107 months, with a mean of 73 months ($SD=21$).

Although 109 mothers and 72 fathers of the 112 children agreed to participate in this study, only 63 mothers (58%) and 39 fathers (54%) returned the questionnaire. Thus parental information was available for 66 children (i.e., 59% of the sample). Three of the children lived with father only, 25 of the children lived with mother only, and 38 lived with both parents. There were no significant differences in children's safety or prevention scores for children from one parent compared to two parent families, nor were differences found between children with a parent returning the questionnaire and those whose parent did not return the questionnaire. The mothers' ages ranged from 21 to 43 years, with a mean of 31 years ($SD=5$). The fathers' ages ranged from 26 to 46 years, with a mean of 34 years ($SD=4$). Additional information on parents' level of education and family income is provided in Table 1. All fathers and 49 mothers (78%) reported being employed full-time. Four mothers (6%) reported part-time employment and ten mothers (16%) indicated they were not employed.

Procedure

Children were interviewed individually at their school during two separate half hour sessions. The content of sessions one and two were counterbalanced to reduce order effect. The children were initially

Table 1
Level of Education and Income for Children's Parents.^a

| <u>Characteristic</u> | <u>Frequency</u> | <u>Percentage</u> |
|----------------------------|------------------|-------------------|
| Mother's education | | |
| some high school | 4 | 6 |
| high school grad | 23 | 37 |
| some college | 15 | 24 |
| technical school grad | 5 | 8 |
| college grad | 12 | 20 |
| advanced degree | 4 | 6 |
| Father's education | | |
| some high school | 3 | 8 |
| high school grad | 6 | 15 |
| some college | 7 | 18 |
| technical school grad | 5 | 13 |
| college grad | 10 | 26 |
| advanced degree | 8 | 21 |
| Family income ^b | | |
| under 5,000 | 2 | 3 |
| 5,000 - 9,999 | 8 | 12 |
| 10,000 - 14,999 | 5 | 8 |
| 15,000 - 19,999 | 10 | 15 |
| 20,000 - 24,999 | 8 | 12 |
| 25,000 - 29,999 | 4 | 6 |
| 30,000 - 34,999 | 6 | 9 |
| 35,000 - 39,999 | 4 | 6 |
| 40,000 - 44,999 | 7 | 11 |
| over 45,000 | 11 | 17 |

Note. ^a63 mothers and 39 fathers returned the questionnaire.

^bFamily income was based on the report of 62 mothers (1 mother left this question blank) and 3 fathers (the mothers did not live with these children).

asked to draw a picture of their choice as a warm-up exercise prior to the actually testing. During the sessions, worksheets indicating each child's responses to the tasks were completed by the interviewer for later scoring. Both sessions were audio taped in order to determine the reliability of scoring.

Session_One. In session one, children's level of causal reasoning was determined by their performance on: (a) a task involving temporal ordering of events in picture sequences similar to the tasks used by Sharp (1982) and Brown and French (1976), (b) a displacement of water task simplified from Piaget (1960), and (c) the identification of factors that are relevant and irrelevant to facilitating and inhibiting the movement of gears and figures in a gear movement toy. In order to determine children's cognitive style of reflection-impulsivity the Matching Familiar Figures Test (Kagan et al., 1964) designed for children was administered.

Session_Two. Children's understanding of safety and prevention was determined by their responses to questions asked after each child viewed 4 X 6-inch color photographs. This same procedure was used in previous research by the current author (Coppens, 1985). The potential injuries depicted in the photographs of unsafe situations represented those cited by the International Children's Centre (1979) as being the most frequent among children (e.g., motor vehicle accidents, poisoning, falls, and burns). (See Appendix C, pages 78 and 79 for descriptions of the situations). Because children were instructed that the situations in the photographs were not safe when questioned about preventive measures, the prevention task always followed the differentiation of safe and unsafe situations task. Immediately following this session, the correct

answers and reasoning concerning safety and prevention were discussed with each child.

Parents. After each child was interviewed, he/she was given the parent questionnaire to take home. Parents were instructed not to discuss the questionnaire with anyone until after completion and then to return the completed questionnaire via the enclosed stamped envelope addressed to the investigator. If the questionnaires had not been returned by two weeks after being sent home with the children, parents were sent a reminder letter and a second questionnaire. In order to identify parent with child, they were both given the same code number.

Measures and Scoring

Pilot Testing Measures. The children's measures were piloted with 12 children from 3 through 8 years of age. This was done to determine if the tasks were appropriate for the age range of this study (e.g., understanding of requests) and the amount of time needed for testing. Revisions were made in the questioning on the gear task to reduce the possibility of chance predictions and the small heavy rock was added to the water displacement task to discriminate between children's explanations concerning weight and size. The revised tasks were then administered to an additional 10 children from 3 through 8 years of age. None of these children attended the same schools as those in the study.

The parent measures were administered initially to undergraduate college students and then to 14 mothers and 13 fathers. They were asked for reactions to format, clarity of instructions, and the time needed for completion. One major modification on the response style questionnaire was to change the format from rank ordering predetermined response categories to giving open-ended answers. This was done to

reduce the social desirability biases which could have been evident in the categories. Also since this part of the study was exploratory, the open-ended format allowed for categories which had not been considered by the investigator. A second group of parents was then administered the revised format to determine clarity of instructions and estimation of completion time.

Each of the measures and its scoring system will now be described (See Appendix C for worksheets used to score children's responses and Appendix D for the parent questionnaire).

Temporal Ordering of Events Task. Children were presented a total of 14 picture sequences. The first two served as a practice trial to clarify directions and were not scored. The color photo sequences used, "Kids at Play" and "Everyday Skills", were produced by Lakeshore Company as curriculum materials. When questioned, none of the children indicated they had previously seen these photographs. An example of one of the sequences consists of the same child going up the steps of a slide and down the slide in a series of five progressive stages. Within each set of five pictures, the same character is depicted performing the same activity at varying stages. In Sharp's (1982) task, the character remained the same in all pictures but the child's activity in the distractors differed from those in the sequence. The similarity of activity was incorporated to control for the possibility of children's selections being based solely on the presence of the same activity.

In Part One, four sets of five sequence cards were shown one set at a time. This was similar to Sharp's (1982) procedure. For two of the four sets, the third and fourth pictures of the sequence were placed on the display board; a blank card marked with an X on it was placed after

the fourth picture. Children were asked to look at the three remaining cards and to place the card that shows what comes next (after) on the X card. For the remaining two sets, the second and third pictures were placed on the display board with the X card before the second picture. Children were asked to look at the three remaining cards and to place the card that shows what comes before (first) on the X card. The request for before (first) and next (fifth) pictures was randomized.

This procedure was continued in Parts Two and Three except now four sets of five sequence cards were shown together at one time. This was similar to Brown and French's (1976) task. In Part Two the same girl was depicted in two of the sets and the same boy in the other two sets. In Part Three adults were depicted in the photographs instead of children.

After children made their selection, a score of 1 was recorded for each correct response. A maximum score of 4 points for each part was possible. This represented a possible total of 12 points for this task. The range of scores for these children was 1 to 12, with a mean of 7.7 (SD=3.4).

Displacement of Water Task. This task was a simplified version of Piaget's (1960) displacement of water-level task. It consisted of two parts. In Part One children were shown a clear glass 1/2 full of water with the level of water marked in red on the outside of the glass, a large rock, and a smaller although heavier rock made out of lead (the difference in rock size or weight was not verbalized to the children). Children were handed the large rock and told to look at it. They were then asked to touch the glass where the top of the water would be after the rock was put in the water. After the glass was touched, the

children were asked why the water would be there. Children were then told to put the rock into the water and the new water level was marked on the outside of the glass in blue. The rock was then removed from the water.

In Part Two children were handed the small (but heavier) rock and told to look at it. They were then asked to touch the glass where the water level would be after the rock was put in the water. After the glass was touched, the children were asked why the water would be there. Children's touching of the glass was not scored since a correct prediction could have occurred by chance. The following points were assigned according to the children's explanation for their predictions concerning water level with a rock in the water: 1 = no mention of the rocks' weight or size; 2 = mentions rocks' weight only; 3 = mentions importance of rocks' weight and size; 4 = mentions size not weight important. This progression of children's explanations concerning water displacement was reported by Piaget (1960). The range in scores for these children was 1 to 4, with a mean of 2 (SD=.9).

Gear_Movement_Task. The gears and figures used in this task came from two "Gear Circus" sets available from Chaselle Inc., a supplier of curriculum materials. When questioned, none of the children indicated they had seen this toy before. A sample gear with a crank on it was shown to the children. They were shown how the sample gear could turn around by moving the crank. Children were then shown a complex sequence of gears designed in the form of a "T" and mounted on a board. On one side there were two areas where gears were not inter-locked which prevented the gear movement from continuing to the end. On the other side the gears were continuous and the movement could continue to the

end. Animal or people figures were located on the second to last gear on each end. Their movement or lack of movement was the effect of interest. The position of the different figures on continuous or noncontinuous sides were alternated across testing sessions. In each of the three parts of this task, a series of questions was asked of the children (See Appendix C, pages 75 and 76 for specific questions). Part One tested children's ability to predict and explain the effect of facilitating (continuous gear connection) and inhibiting (space between gears) influences on resulting gear movement before the demonstration of the gear display. Prior to the questioning in Part Two, the gear movement and lack of movement was demonstrated but not verbalized to the children.

Parts Two and Three tested children's ability to predict and explain the causal connection between removing and adding relevant and irrelevant parts and gear movement. A part was considered relevant if its removal or addition had an effect on inhibiting (e.g., removal of necessary gear) or facilitating (e.g., adding necessary gear) the gear movement and/or lack of movement which had just been demonstrated. An irrelevant part had no effect on inhibiting or facilitating gear movement (e.g., animal added to people side). In Part Two the parts were removed one at a time, then replaced before another part was removed. The order of part removal was randomized. Part Three tested children's ability to predict and explain the effect of adding relevant and irrelevant parts on gear movement. Parts were added one at a time, then removed before another part was added (except the gear added to connect the first space was left in place). The order of adding parts was randomized.

The possible score for Parts One, Two, and Three was 5, 8, and 12 points, respectively. This represented a possible total of 25 points. The range in scores for these children was 0 to 25, with a mean of 10.1 (SD=8.3).

Matching Familiar Figures Test (MFFT). This task was scored in the standard manner (Kagan et al., 1964). The time between the presentation of the item and children's first response was recorded and summed across all 12 items. Separate scores for total latency and number of errors were calculated. The range in total latency scores for these children was 23 to 381 seconds, with a mean of 99 (SD=71.1). And the range in total errors was 3 to 36, with a mean of 18.5 (SD=9.2).

Differentiation of Safe and Unsafe Situations Task. The task and scoring were the same as those used in previous research which measured children's understanding of safety (Coppens, 1985). The 11 pairs of photographs used in this task were selected from a larger sample on the basis of the following criteria: (a) 100% agreement by 25 college students, blind to the hypotheses and interviewed individually, that the events depicted in each photograph were safe or not safe, (b) within a pair the same child and environment were shown, (c) different male and female children were depicted across pairs to reduce carry-over effects and sex biases, and (d) the environment and event depicted varied across pairs (e.g., standing vs. sitting in a grocery cart, wearing a seat belt vs. leaning on the dash board). The photographs were shown to the child one pair at a time in random order. For half of the pairs of photographs, children were asked to pick the safe situation, and for the remaining pairs to pick the unsafe situation. After their selection was made, children were questioned to determine if they could describe the

presence or absence of an accident agent and the potential injury in the unsafe photograph. One point was given for correctly selecting either the safe or unsafe photograph. A second point was given for a why response which identified either a facilitating cause (request for unsafe situation) or an inhibiting cause (request for safe situation). A third point was given for identification of the potential injury in the unsafe photograph. This scoring represented a possible 3 points per pair with a maximum possible total of 33 points. The range in scores for these children was 4 to 33, with a mean of 28, (SD=6.3). A paired T-test was conducted to detect differences in children's performance when the initial request was for the unsafe situation compared to the safe situation. The results revealed no differences, $t(111)=1.5$, $p > .05$.

Specification of Preventive Measures Task. To determine children's ability to specify preventive measures, five single photographs depicting a child in an unsafe situation were shown in random order. These photographs were chosen from a larger sample on the basis of 100% agreement by college students that the situations were unsafe and specific measures could be taken to prevent either the situation or injury (e.g., a child standing on a chair attempting to remove medicine bottles from a high shelf; instead, the medicine could have been placed in a locked cabinet or taken away from the child before ingestion). The task and scoring were the same as those used in previous research which measured children's understanding of prevention (Coppens, 1985). After viewing each photograph, children were asked a series of five questions: (a) what could be done so the child in the picture would be safe, (b) what could the child in the picture do so he/she would be safe, (c) what

could you do so the child in the picture would be safe, (d) what could somebody else do so the child in the picture would be safe, and (e) can you think of anything else that could be done so the child would be safe. These questions were included as a means of probing for different types of preventive measures. If in response to the first question, the subject gave an action the child in the photograph could do, for the second question the subject would be asked what else could the child in the photograph do to be safe. This method of probing continued for the remaining questions. A preventive measure was considered correct if it was an action that either prevented the unsafe situation or stopped the occurrence of injury. This scoring represented a possible 5 points per photograph with a possible total of 25 points. The range in scores for these children was 0 to 25, with a mean of 14 (SD=7.2).

Parents' Style of Responding Questionnaire. This questionnaire described eight hypothetical situations involving a child: (a) in five the child was doing an unsafe action, (b) in one the child was doing an action to prevent injury, and (c) in two the child's actions were not related to safety. The situations of interest to the current study were the five in which the child was doing an unsafe action (e.g., You walk into the bathroom and see your child counting pills from a bottle of your medicine, See Appendix D, pages 82 to 84 for situations 1, 2, 3, 6, and 7). Parents were instructed after reading each situation to write what their entire response would be if this was the first time they saw their child do the described action and then what their response would be if this was the second time they had seen their child do this same action. They were also told their response to the first and second time may be the same or different.

Parents' responses were coded according to the following preestablished categories: removal of accident agent, consequential thinking, tells status of situation, questioning, behavioral conformity, and punishment. These categories were based on Holden (1983), Lytton (1980), and Masur's (1982) findings and this investigator's observations of parent-child interactions in potentially unsafe situations. Parental responses indicated the need to divide the punishment category into physical punishment, verbal punishment, and discipline. A description of each category is provided in Table 2. A few parents indicated they would take no action the second time they saw the child in the situation. (See Appendix E for the frequency of mothers and fathers using each response category).

In order to determine parents' style of response, their individual responses for the first time they saw the child in the five unsafe situations were compared. If their responses to three out of five situations indicated the same category, this was the parents' response style. If the parents did not utilize the same response category for three out of five situations, they were considered as having no consistent style. Since few parents used behavioral conformity, questioning, and tells status of situation consistently, those categories were classified as other.

Determinants of Children's Development Questionnaire. Parents were asked to rate eight statements concerning children's development on a 7 point heredity-environment continuum (e.g., Children within the same family may have different personalities because of:; See Appendix D, page 81 for the entire questionnaire). It was scored so that a high score represented a belief in environment as a determinant, a middle

Table 2
Categories of Parents' Responses to Children in Unsafe Situations.

| Category | Definition | Examples |
|------------------------------|---|--|
| Behavioral Conformity | Parent tells child to stop a behavior, what action to take, or to avoid a situation without explaining the reason for the change in behavior. | "Never do that again," "Stay away from that," "Look both ways." |
| Physical Punishment | Parent applies physical force to the child. | "Spank hand," "Hit bottom." |
| Verbal Punishment | Parent yells, lectures, verbalizes disappointment. | "Instill fear," "Reprimand," "threat." |
| Discipline | Parent removes a favored activity. If mentions punishment but does not indicate if verbal or physical, categorized as discipline. | "Send to bedroom," "Take away ball for a week," "Punish." |
| Removal of Accident Agent | Parent removes unsafe objects from the situation. | "Puts pills away," "Fan put up high," |
| Consequential Thinking | Parent explains verbally or through demonstration, cause and effect relationships between accident agent and potential injury. | "If you pull on cord, iron could fall on you," "You'll get sick if take wrong or too many pills." |
| Questioning | Parent questions child as to what he/she is doing. | "Why are you doing that?" |
| Tells Status of Situation | Parent tells child the situation is not safe but does not explain why. | "It's dangerous," "That's not safe." |

score an equal combination of heredity and environment, and a low score a belief in heredity as a determinant of children's development. The possible range of scores was from 8 to 56. The range of scores for these mothers was 20 to 49, with a mean of 30.9 (SD=6.0). And the range of scores for these fathers was 12 to 44, with a mean of 32.4 (SD=6.3).

Reliability. Reliability for the scoring of children's responses on the water displacement, safety, and prevention tasks was determined by having an independent rater score 34 randomly selected transcriptions of sessions one and two. The percentage agreement between this investigator's on site scoring and the independent rater were 91% for the water displacement task, 98% for the safety task, and 97% for the prevention task. Because of the nonverbal indicators present in the other child measures, reliability of their scoring could not be determined from the audio tapes. The comparison of these two raters' categories for 13 fathers' and 19 mothers' responses on the Parental Style of Responding questionnaire indicated a range of 94 to 100% agreement for individual parents, with 98% agreement across all responses. The alpha reliability coefficients for child measures and the Determinants of Children's Development questionnaire are presented in Table 3.

Table 3
Alpha Reliability Coefficients and Mean Inter-item Correlations.

| Measure | n | alpha | mean inter-item r |
|---|-----|-------|-------------------|
| Safety | 112 | .93 | .30 |
| Prevention | 112 | .94 | .37 |
| Temporal sequencing | 112 | .84 | .30 |
| Gears | 112 | .95 | .48 |
| Determinants of Children's Development: Mothers' | 61 | .68 | .21 |
| Fathers' | 39 | .68 | .21 |

III. RESULTS

Preliminary analyses indicated no sex differences on the child measures. Therefore, scores for boys and girls were combined in all subsequent analyses.

In order to test the hypothesis that children can differentiate between safe and unsafe situations before they are able to specify preventive measures, frequencies of children scoring within 5 point intervals on the safety and prevention measures were cast into an expectancy table (See Table 4). None of the children who scored in the lower range of safety scores scored high on the prevention task. In addition, the mean percentage score on the safety task was 85% compared to 56% on the prevention task. These data indicate that the children's differentiation of safe and unsafe situations occurs prior to their specification of preventive measures. They also provide support for examining safety and prevention scores separately.

The three hypotheses, that referred to children's level of causal reasoning and their cognitive style, were tested by means of correlations. The correlations for the entire group were examined initially, followed by separate correlational analyses for the 3 to 5 year old and 6 to 8 year old groups. The separate correlations were conducted to examine age-related changes in children's performance on the tasks in question, which might help explain the differences in rate of accidents for preschool versus school-age children. Prior to conducting the correlational analyses, the researcher checked each measure's scores for normality of distribution by comparing their value

Table 4
Percentage of Children at Different Intervals of Safety and Prevention
Scores.

| Safety | Number | Prevention | | | | |
|---------|--------|------------|-------|---------|---------|---------|
| | | 0 - 4 | 5 - 9 | 10 - 14 | 15 - 19 | 20 - 25 |
| 30 - 33 | 62 | 2% | 2% | 16% | 29% | 52% |
| 25 - 29 | 27 | 7% | 11% | 59% | 19% | 4% |
| 20 - 24 | 10 | 40% | 30% | 20% | 10% | 0% |
| 15 - 19 | 6 | 50% | 50% | 0% | 0% | 0% |
| 10 - 14 | 5 | 100% | 0% | 0% | 0% | 0% |
| 5 - 9 | 1 | 100% | 0% | 0% | 0% | 0% |
| 0 - 4 | 1 | 100% | 0% | 0% | 0% | 0% |

for skewness against the standard error for skewness (Tabachnick & Fidell, 1983). The safety and MFFT latency scores were significantly skewed (i.e., -1.7 and 1.9, respectively) while all the other measures were skewed less than .5. To reduce their skewness, logarithmic transformations were performed on the safety and latency scores. Because the safety scores were negatively skewed, they were "reflexed" prior to the transformation (Tabachnick & Fidell, 1983). Because the reflexing resulted in high scores becoming low and vice versa, the sign of the correlations became reversed. To ease interpretations the sign of these correlations was reversed again for presentation. Correlation coefficients resulting from these analyses are presented in Table 5.

Causal Reasoning

The correlations for the total and separate groups provided support for the hypothesis that a positive correlation exists between children's causal reasoning scores and their safety and prevention scores.

Although the correlations for the older group were significant, they were relatively lower in magnitude than those of the younger group. This difference may have been a result of the reduced variability within the older group, or it may be that less of a relationship exists between the older children's level of causal reasoning and their understanding of safety and prevention.

Next, stepwise multiple regression analyses were conducted to examine the shared versus unique variance of the causal reasoning measures in predicting safety and prevention scores. Because children's age (in months) was significantly correlated with safety and prevention scores it was entered first in all subsequent regression analyses to determine how much variance the predictors could explain in addition to

Table 5
Correlations of Predictor and Criterion Measures for Total Group,
3 to 5 year olds, and 6 to 8 year olds.

| Measures | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|------------------------|---------|---------|---------|---------|---------|---------|--------|
| Total Group (N = 112) | | | | | | | |
| 1 Age (months) | | | | | | | |
| Causal Reasoning: | | | | | | | |
| 2 Gears | .75*** | | | | | | |
| 3 Displacement | .62*** | .63*** | | | | | |
| 4 Temporal | .77*** | .79*** | .72*** | | | | |
| Cognitive Style: | | | | | | | |
| 5 Latency | .59*** | .59*** | .54*** | .63*** | | | |
| 6 Errors | -.78*** | -.71*** | -.61*** | -.74*** | -.73*** | | |
| Criterion: | | | | | | | |
| 7 Safety | .77*** | .77*** | .66*** | .75*** | .55*** | -.69*** | |
| 8 Prevention | .75*** | .76*** | .66*** | .79*** | .56*** | -.67*** | .82*** |

3, 4, and 5 year olds (n = 55)

| | | | | | | | |
|-------------------|---------------------|---------------------|---------------------|---------------------|---------|---------|--------|
| 1 Age (months) | | | | | | | |
| Causal Reasoning: | | | | | | | |
| 2 Gears | .54*** | | | | | | |
| 3 Displacement | .55*** ^a | .56*** ^a | | | | | |
| 4 Temporal | .61*** ^a | .68*** | .70*** ^a | | | | |
| Cognitive Style: | | | | | | | |
| 5 Latency | .26* | .33** | .33** | .35** | | | |
| 6 Errors | -.35** | -.51*** | -.42** | -.48*** | -.54*** | | |
| Criterion: | | | | | | | |
| 7 Safety | .56*** | .65*** | .55*** | .60*** ^a | .21 | -.44*** | |
| 8 Prevention | .52*** | .69*** | .55*** | .63*** | .23* | -.30* | .74*** |

6, 7, and 8 year olds (n = 57)

| | | | | | | | |
|-------------------|-------------------|-------------------|-------------------|-------------------|---------|--------|--------|
| 1 Age (months) | | | | | | | |
| Causal Reasoning: | | | | | | | |
| 2 Gears | .29* | | | | | | |
| 3 Displacement | -.09 ^a | .24* ^a | | | | | |
| 4 Temporal | .09 ^a | .55*** | .23* ^a | | | | |
| Cognitive Style: | | | | | | | |
| 5 Latency | -.01 | .25* | .19 | .30* | | | |
| 6 Errors | -.40** | -.31** | -.10 | -.29* | -.46*** | | |
| Criterion: | | | | | | | |
| 7 Safety | .30* | .49*** | .26* | .30* ^a | .20 | -.23* | |
| 8 Prevention | .35* | .51*** | .27* | .46*** | .29* | -.36** | .56*** |

Note. ^a Significant difference (p < .05) between pairs of 3 to 5 and 6 to 8 year olds' coefficients, when r changed to Fisher's Z statistic.

* p < .05 ** p < .01 *** p < .001

this general index of development (See Table 6). For all of the regression analyses, at least one of the measures of causal reasoning contributed a significant amount of variance in explaining safety and prevention scores, in addition to that already explained by age. It appears that the selection of the preferred causal predictor was influenced by the amount of variance it had in common with age. For example, although the zero-order correlation between the temporal measure and safety score was higher than between displacement and safety, displacement entered as a significant predictor and temporal did not. Examining the correlation matrix for all ages indicates that temporal was more highly correlated with age than the other measures of causal reasoning.

Cognitive Style

The correlations for the total group provided support for the hypothesis that a positive relationship exists between children's response time on the MFFT (latency score) and their safety and prevention scores (See Table 5). However, when examined separately for the younger and older age groups, latency was no longer significantly related to safety score. In contrast, the hypothesis that a negative correlation exists between children's MFFT error score and their safety and prevention scores was supported for both the total group and separate age groups (See Table 5). Multiple regression analyses were then conducted to determine the relative importance of errors and latency as predictors of safety and prevention scores after controlling for the effect of age (See Table 7). The interaction terms were also entered in the regression analyses. Because the interactions were not significant predictors, they were not included in Table 7.

Table 6
Multiple Regressions with Children's Age and Level of Causal Reasoning Regressed on Safety and Prevention Scores.

| Criterion | Step | Predictor | Beta | F ^a | r | R | R ² |
|--------------------------------|------|--------------|------|----------------|-----|-----|----------------|
| Total Group (N = 112) | | | | | | | |
| Safety | 1 | Age | .77 | 155.3** | .77 | .77 | .59 |
| | 2 | Gears | .44 | 27.9** | .77 | .82 | .67 |
| | 3 | Displacement | .21 | 8.2** | .66 | .83 | .69 |
| | 4 | Temporal | .13 | 1.4 | .75 | .83 | .70 |
| Prevention | 1 | Age | .75 | 140.5** | .75 | .75 | .56 |
| | 2 | Temporal | .52 | 35.2** | .79 | .82 | .67 |
| | 3 | Gears | .29 | 9.7** | .76 | .83 | .70 |
| | 4 | Displacement | .13 | 2.9 | .66 | .84 | .70 |
| 3, 4, and 5 year olds (n = 55) | | | | | | | |
| Safety | 1 | Age | .56 | 24.8** | .56 | .56 | .32 |
| | 2 | Gears | .48 | 16.4** | .65 | .69 | .48 |
| | 3 | Displacement | .20 | 2.4 | .55 | .71 | .51 |
| | 4 | Temporal | .11 | .4 | .60 | .71 | .51 |
| Prevention | 1 | Age | .52 | 19.3** | .52 | .52 | .27 |
| | 2 | Gears | .57 | 24.1** | .69 | .71 | .50 |
| | 3 | Temporal | .25 | 3.1 | .63 | .73 | .53 |
| | 4 | Displacement | .11 | .6 | .55 | .73 | .53 |
| 6, 7, and 8 year olds (n = 57) | | | | | | | |
| Safety | 1 | Age | .30 | 5.5* | .30 | .30 | .09 |
| | 2 | Gears | .44 | 13.2** | .49 | .52 | .27 |
| | 3 | Displacement | .18 | 2.3 | .26 | .55 | .30 |
| | 4 | Temporal | .03 | .0 | .30 | .55 | .30 |
| Prevention | 1 | Age | .35 | 7.5** | .35 | .35 | .12 |
| | 2 | Gears | .45 | 14.4** | .51 | .55 | .31 |
| | 3 | Temporal | .28 | 4.4* | .46 | .60 | .36 |
| | 4 | Displacement | .18 | 2.4 | .27 | .62 | .39 |

Note. ^a Test for increment in proportion of variance accounted for.
 * p < .05 ** p < .01.

Table 7

Multiple Regressions with Children's Age and Cognitive Style
(MFFT Latency and MFFT Errors) Regressed on Safety and
Prevention Scores.

| Criterion | Step | Predictor | Beta | F ^a | r | R | R ² |
|---------------------------------|------|-----------|------|----------------|------|-----|----------------|
| Total Group (N = 112) | | | | | | | |
| Safety | 1 | Age | .77 | 155.3** | .77 | .77 | .59 |
| | 2 | Errors | -.24 | 6.8* | -.69 | .78 | .61 |
| | 3 | Latency | .06 | .5 | .55 | .78 | .61 |
| Prevention | 1 | Age | .75 | 140.5** | .75 | .75 | .56 |
| | 2 | Latency | .18 | 5.7* | .56 | .76 | .58 |
| | 3 | Errors | -.12 | 1.1 | -.67 | .77 | .59 |
| 3, 4, and 5 year olds (n = 55) | | | | | | | |
| Safety | 1 | Age | .56 | 24.8** | .56 | .56 | .32 |
| | 2 | Errors | -.27 | 5.4* | -.44 | .62 | .38 |
| | 3 | Latency | .08 | .4 | .21 | .62 | .39 |
| Prevention | 1 | Age | .52 | 19.3* | .52 | .52 | .27 |
| | 2 | Errors | -.14 | 1.2 | -.30 | .53 | .28 |
| | 3 | Latency | .05 | .1 | .23 | .53 | .29 |
| 6, 7, and 8 year olds (n = 57) | | | | | | | |
| Safety | 1 | Age | .30 | 5.5* | .30 | .30 | .09 |
| | 2 | Latency | .20 | 2.5 | .20 | .36 | .13 |
| | 3 | Errors | .03 | .0 | -.23 | .36 | .13 |
| Prevention | 1 | Age | .35 | 7.5** | .35 | .35 | .12 |
| | 2 | Latency | .29 | 5.7* | .29 | .45 | .21 |
| | 3 | Errors | -.14 | .8 | -.36 | .47 | .22 |

Note.^aTest for increment in proportion of variance accounted for.

* p < .05 ** p < .01.

When the total group was considered, errors was the preferred predictor for safety score and latency preferred for explaining prevention scores. The zero-order correlations indicated MFFT errors should have been the preferred predictor for both criterion measures; however, it was also more highly correlated with age than latency. When age was eliminated from the regression analyses, errors replaced latency as a significant predictor of prevention scores. Thus, the unique variance contributed by latency was no longer significant. When the regression analyses were conducted separately for 3 to 5 year olds and 6 to 8 year olds, error score was the preferred predictor for the younger group and latency for the older group. However, again when age was eliminated from the analyses for the older age group, errors replaced latency as a significant predictor of prevention scores. For this older group error score was significantly correlated with age while latency was not.

Significant Causal Reasoning and Cognitive Style Predictors

In order to determine the unique variance contributed by the significant causal reasoning and cognitive style predictors, multiple regression analyses were conducted entering them in stepwise fashion after age (See Table 8). For all of the regression analyses, the causal reasoning measures were entered before cognitive style and therefore remained as significant predictors of safety and prevention scores. Since none of the measures of cognitive style remained significant as predictors, this suggested the variance they explained was shared with causal reasoning. However, when cognitive style was forced to enter after age and before causal reasoning, the measures of causal reasoning still accounted for a significant increment in the explained variance of

Table 8
Multiple Regressions of Significant Causal Reasoning and Cognitive Style
Predictors Regressed on Safety and Prevention Scores.

| Criterion | Step | Predictor | Beta | F ^a | r | R | R ² |
|---------------------------------|------|--------------|------|----------------|------|-----|----------------|
| Total Group (N = 112) | | | | | | | |
| Safety | 1 | Age | .77 | 155.3** | .77 | .77 | .59 |
| | 2 | Gears | .44 | 27.9** | .77 | .82 | .67 |
| | 3 | Displacement | .21 | 8.2** | .66 | .83 | .69 |
| | 4 | Errors | -.08 | .8 | -.69 | .83 | .70 |
| Prevention | 1 | Age | .75 | 140.5** | .75 | .75 | .56 |
| | 2 | Temporal | .52 | 35.2** | .79 | .82 | .67 |
| | 3 | Gears | .29 | 9.7** | .76 | .83 | .70 |
| | 4 | Latency | .03 | .2 | .56 | .83 | .70 |
| 3, 4, and 5 year olds (n = 55) | | | | | | | |
| Safety | 1 | Age | .56 | 24.8** | .56 | .56 | .32 |
| | 2 | Gears | .48 | 16.4** | .65 | .69 | .48 |
| | 3 | Errors | -.11 | 1.0 | -.44 | .70 | .49 |
| 6, 7, and 8 year olds (n = 57) | | | | | | | |
| Prevention | 1 | Age | .35 | 7.5** | .35 | .35 | .12 |
| | 2 | Gears | .45 | 14.4** | .51 | .55 | .31 |
| | 3 | Temporal | .28 | 4.4* | .46 | .60 | .36 |
| | 4 | Latency | .15 | 1.8 | .29 | .62 | .38 |

Note.^aTest for increment in proportion of variance accounted for.
 * p < .05 ** p < .01.

safety and prevention scores. Thus measures of causal reasoning appear to be the preferred predictor of children's understanding of safety and prevention.

In order to examine more closely the developmental nature of children's performance on the measures, the means and standard deviations for each age, according to years, are presented in Table 9. A progression existed in that there was an increase in the means and a decrease in the standard deviations from 3 to 8 years of age. For many of the measures there was a dramatic difference between the 3 to 5 year olds' and the 6 to 8 year olds' performance (e.g., the difference in their performance on the MFFT). The reduced variability in the older children's safety scores was also noted, this probably reflects a ceiling effect for this measure. More than half of the children in the 6 to 8 year old group had a perfect safety score (See Appendix F for correlation coefficients between predictors and safety with perfect safety scores omitted). On the other hand only one child, who was from the older age group, had a perfect prevention score.

The mean performance of the 3 to 5 year old and the 6 to 8 year old groups on the individual prevention questions was compared to evaluate whether the younger children's relatively poorer performance may have been due to the request of a particular question (e.g., question number 4 that requested "what could someone else do?" may have been difficult for the younger children because of their egocentrism rather than a reflection of their understanding of prevention) (See Appendix G for means and standard deviations for the prevention questions). The means and standard deviations within the age groups were similar across the first four questions. However, both the older and younger age groups

had relatively poorer performance on the last question which asked: "Can you think of anything else that could be done so the child would be safe?". The general nature of this final question suggests the children's poor performance may be a result of their inability to specify an additional type of preventive measure rather than this question being more difficult than the previous four questions.

Parents' Style of Responding

The statistics presented are based on a subset of the children's parents (i.e., the 63 mothers and 39 fathers who returned the questionnaire); therefore, caution should be taken in making generalizations and drawing conclusions from the results.

The variety of parents' responses, represented by the eight categories, indicated considerable individual differences in how parents would respond to children who were in unsafe situations (frequency of individual responses per category can be found in Appendix E). A large percentage of parents' responses revealed they would respond differently depending on the type of unsafe situation; this was evident in the number of parents who had no consistent response style (i.e., the same response was not used for three out of five unsafe situations).

Parents' styles of responding were grouped separately for 3 to 5 year olds and 6 to 8 years olds (See Table 10). This was done to examine the possibility that parents' responses may vary with the age of the child. The only apparent difference between parents of younger and older children was that more parents of older children had no consistent response style. For both age groups, differences in parents' response style was evident when the first and the second time a child was observed in an unsafe situation were compared. For example, no parent

Table 9
Means (Standard Deviations) for Predictor and Criterion Measures
by Age.

| Measures | Age in Years | | | | | |
|---------------------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|
| | 3 | 4 | 5 | 6 | 7 | 8 |
| Causal Reasonings: | | | | | | |
| Gears | 2.8 (3.3) | 2.2 (2.4) | 7.4 (5.4) | 13.2 (7.4) | 14.9 (7.3) | 19.6 (4.5) |
| Displacement | 1.1 (.3) | 1.2 (.5) | 2.1 (1.0) | 2.6 (.9) | 2.7 (.8) | 2.6 (.7) |
| Temporal | 3.9 (1.8) | 4.6 (2.3) | 7.3 (2.9) | 9.8 (2.1) | 10.2 (1.4) | 10.5 (1.6) |
| Cognitive Styles: | | | | | | |
| Latency | 60.6 (74.8) | 55.2 (22.0) | 76.9 (46.4) | 122.3 (65.3) | 141.8 (86.8) | 133.4 (54.7) |
| Errors | 27.2 (5.5) | 26.8 (5.4) | 22.1 (8.7) | 14.9 (6.2) | 10.6 (3.1) | 9.9 (4.1) |
| Criteria: | | | | | | |
| Safety | 20.1 (8.3) | 23.9 (5.1) | 28.8 (3.6) | 30.7 (2.7) | 31.9 (2.0) | 32.6 (.8) |
| Prevention | 6.4 (6.6) | 7.9 (5.3) | 12.9 (5.2) | 16.4 (5.0) | 19.4 (3.7) | 20.4 (2.8) |

would consistently use physical punishment if this was the first time they observed the child in the unsafe situations. However, four fathers and eight mothers indicated they would if it were the second time the child was observed in the unsafe situations. Another difference which appeared in parents' response style was between mothers' and fathers' removal of the accident agent. Only one father indicated he would consistently remove the accident agent, while several mothers indicated this would be their response.

Examination of individual response styles indicated ten mothers of the younger children (33%) and nine mothers of the older children (27%) would respond in the same way the first and second time they observed the child in the unsafe situations. Five fathers of the younger children (28%) and one father of an older child (5%) responded with the same style the first and second time they observed the child. Comparisons were also made between the 35 pairs of mothers and fathers who both used a response style consistently. Eight pairs of mothers and fathers (23%) used the same response style when it was the first time they observed the child in the unsafe situations, while only two pairs of mothers and fathers (5%) indicated the same style if it were the second time the child was observed.

To determine whether a relationship existed between parents' response style and children's safety and prevention scores, multiple regression analyses were conducted with response categories dummy coded and entered as predictors of safety and prevention scores. Because no a priori predictions were made concerning the parent measures and multiple comparisons were made, the alpha level was set at the .01 level to reduce the possibility of Type I error. None of the regression

Table 10

Frequency of Parents' Response Styles to First and Second Time Child Observed in Unsafe Situations.

| Parents' Response Styles | 3 to 5 year olds ^a | | 6 to 8 year olds ^b | |
|---------------------------|-------------------------------|---------|-------------------------------|----------|
| | First | Second | First | Second |
| Fathers: | | | | |
| Physical Punishment | 0 (0%) | 3 (17%) | 0 (0%) | 1 (5%) |
| Verbal Punishment | 5 (28%) | 2 (11%) | 0 (0%) | 1 (5%) |
| Discipline | 0 (0%) | 2 (11%) | 0 (0%) | 3 (15%) |
| Removal of Accident Agent | 1 (6%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Consequential Thinking | 8 (44%) | 4 (22%) | 8 (40%) | 2 (10%) |
| Other | 1 (6%) | 1 (6%) | 2 (10%) | 0 (0%) |
| No Consistent Style | 3 (17%) | 6 (33%) | 10 (50%) | 13 (65%) |
| Mothers: | | | | |
| Physical Punishment | 0 (0%) | 7 (23%) | 0 (0%) | 1 (3%) |
| Verbal Punishment | 4 (13%) | 4 (13%) | 1 (3%) | 2 (6%) |
| Discipline | 0 (0%) | 5 (17%) | 0 (0%) | 3 (9%) |
| Removal of Accident Agent | 3 (10%) | 1 (3%) | 5 (15%) | 2 (6%) |
| Consequential Thinking | 14 (47%) | 5 (17%) | 14 (42%) | 7 (21%) |
| Other | 1 (3%) | 2 (7%) | 1 (3%) | 1 (3%) |
| No Consistent Style | 8 (27%) | 6 (20%) | 12 (36%) | 17 (52%) |

Note.^a 18 fathers and 30 mothers of 3 to 5 year olds completed the questionnaire.

^b 20 fathers and 33 mothers of 6 to 8 year olds completed the questionnaire.

outcomes, which considered separate response style categories, had a significant F value. Because this may have resulted from the small number in many categories, a series of contrasts were made which combined categories.

Separate eta analyses were conducted with parents' response style categories as the independent variable and their children's safety and prevention scores as the dependent variables. The first contrast considered parents having any style versus those with no consistent style. The subsequent contrasts omitted from the analyses parents with no consistent style: (a) using discipline, physical punishment, or verbal punishment versus consequential thinking, (b) using any consistent style other than consequential thinking versus using consequential thinking, (c) mothers and fathers using the same style versus using different styles, and (d) using the same style versus different styles for the first and second time the situations were observed. These analyses for 3 to 5 year olds, 6 to 8 year olds, and all age groups together revealed that parents' response style, whether it was the first or second time the child was observed in the unsafe situations, did not account for a significant amount of the variance in children's safety or prevention scores. The majority of the 96 eta analyses conducted accounted for less than 4% of the variance in children's performance.

Although nonsignificant, the contrast of parents using discipline, physical punishment, or verbal punishment versus those using consequential thinking indicated the lowest probability levels with the largest amount of explained variance in children's performance. For both mothers ($n = 13$) and fathers ($n = 7$), of the 6 to 8 year olds,

this contrast of response styles for the second time the child was observed in the unsafe situations accounted for 29% of the variability in children's safety scores. When prevention scores were considered as the dependent variable this contrast of mothers' response styles still accounted for 29%, while fathers' styles accounted for 19% of the variance in children's performance. Differences were also evident in the amount of variance in 3 to 8 year olds' prevention scores that were accounted for by mothers' and fathers' use of verbal punishment versus consequential thinking the first time the child was observed in the unsafe situations. Fathers' style ($n = 21$) accounted for 25%, while mothers' style ($n = 33$) accounted for 2% of the variance in prevention scores.

Determinants of Children's Development

The possibility of a relationship between fathers' or mothers' score on the Determinants of Children's Development questionnaire and children's safety or prevention scores was examined with correlations. Since the linear components were not statistically significant, the possibility of curvilinear relationships between parents' score and children's safety or prevention scores were considered by conducting multiple regression analyses. However as can be seen in Table 11 for fathers' score and Table 12 for mothers' score, the quadratic components were also nonsignificant at the .01 level.

Table 11
Multiple Regression of Fathers' Determinants of Development
Scores Regressed on Children's Safety and Prevention Scores.

| Criterion | Step ^a | Beta | F ^b | r | R | R ² |
|---------------------------------|-------------------|-------|----------------|------|-----|----------------|
| Total Group (n = 39) | | | | | | |
| Safety | 1 | .11 | .46 | .11 | .11 | .01 |
| | 2 | -1.01 | .90 | .09 | .19 | .04 |
| Prevention | 1 | .27 | 2.92 | .27 | .27 | .07 |
| | 2 | -.60 | .33 | .25 | .29 | .08 |
| 3, 4, and 5 year olds (n = 18) | | | | | | |
| Safety | 1 | .18 | .53 | .18 | .18 | .03 |
| | 2 | -1.72 | 1.30 | .13 | .33 | .11 |
| Prevention | 1 | .26 | 1.16 | .26 | .26 | .07 |
| | 2 | -.98 | .42 | .23 | .30 | .09 |
| 6, 7, and 8 year olds (n = 21) | | | | | | |
| Safety | 1 | -.02 | .01 | -.02 | .02 | .00 |
| | 2 | -.84 | .11 | -.03 | .08 | .01 |
| Prevention | 1 | .32 | 2.20 | .32 | .32 | .10 |
| | 2 | -.26 | .01 | .32 | .32 | .10 |

Note. ^a Linear component of fathers' Determinants of Development scores entered in step 1 and quadratic component in step 2.

^b Test for increment in proportion of variance accounted for resulted in F levels with $p > .01$.

Table 12

Multiple Regression of Mothers' Determinants of Development Scores Regressed on Children's Safety and Prevention Scores.

| Criterion | Step ^a | Beta | F ^b | r | R | R ² |
|--|-------------------|-------|----------------|------|-----|----------------|
| Total Group (n = 61) ^c | | | | | | |
| Safety | 1 | -.05 | .14 | -.05 | .05 | .00 |
| | 2 | -2.86 | 6.04 | -.08 | .31 | .10 |
| Prevention | 1 | -.03 | .04 | -.03 | .03 | .00 |
| | 2 | -2.71 | 5.36 | -.06 | .29 | .09 |
| 3, 4, and 5 year olds (n = 28) ^c | | | | | | |
| Safety | 1 | -.26 | 1.95 | -.26 | .26 | .07 |
| | 2 | -1.74 | 1.12 | -.29 | .33 | .11 |
| Prevention | 1 | -.16 | .72 | -.16 | .16 | .03 |
| | 2 | -1.61 | .92 | -.18 | .25 | .06 |
| 6, 7, and 8 year olds (n = 33) | | | | | | |
| Safety | 1 | -.15 | .76 | -.15 | .15 | .02 |
| | 2 | -1.20 | .31 | -.16 | .18 | .03 |
| Prevention | 1 | -.23 | 1.81 | -.23 | .23 | .06 |
| | 2 | -.06 | .01 | -.23 | .23 | .06 |

Note. ^a Linear component of mothers' Determinants of Development scores entered in step 1 and quadratic component in step 2.

^b Test for increment in proportion of variance accounted for resulted in F levels with p > .01.

^c Two mothers in the 3 to 5 year old group did not complete the questionnaire.

IV. DISCUSSION

The results of this study were consistent with previous research (Coppens, 1985) and indicate that there are age-related differences in children's understanding of safety and accident prevention which parallel cognitive development. The present findings, based on preschool and school-age children from a range of socio-economic status levels, support the view that both children's level of causal reasoning and their cognitive style are related to their understanding of safety and accident prevention. Examination of children's safety and prevention scores also indicated that an understanding of safety occurs before children are able to specify measures for preventing accidents.

Based on the self-reports of how parents speculated they would respond to children in unsafe, hypothetical situations, different response styles did exist and many parents' responses varied depending on the type of unsafe situations. But whether parents who respond in a particular way have children who are more adept at differentiating between safe and unsafe situations and at specifying preventive measures remains an empirical question. Similarly, there were no significant relationships evident between parents' belief in heredity and/or environment as determinants of children's development and their children's understanding of safety and accident prevention.

Theoretical Implications

The positive correlations between children's performance on the three measures of causal reasoning and their safety and prevention scores provided support for the hypothesis that children with a higher

level of causal reasoning have a more accurate understanding of safety and prevention. It appears that one measure of causal reasoning ability is sufficient to detect its relationship with children's understanding of the concepts of safety and accident prevention as defined here. The shared variance between the criterion and causal reasoning scores was given to the causal reasoning score that entered first in the regression analysis, thereby reducing the explanatory power of the two remaining causal reasoning scores. However when both age groups were combined for analyses, two measures of causal reasoning did account for unique variance in the safety and prevention scores. This suggests the necessity of variability among children's abilities for the second causal reasoning measure to provide additional explanation of performance on the criterion measures. Cognitive characteristics of the children in addition to causal reasoning, such as their conception of movement and speed (Piaget, 1971), might be used by children to calculate the safeness of situations and determine actions appropriate for preventing accidents.

Performance on the gear movement task was the preferred causal reasoning predictor of children's understanding of safety and accident prevention for five out of the six regression analyses. For the total sample and the 3 to 5 year olds, this entrance in the regression appears to be a function of the amount of shared variance between performance on the gear task and age. However, for the 6 to 8 year olds the gear task score was significantly correlated with age while performance on the other causal measures was not. It may have remained the preferred causal reasoning predictor for the older age group because of the nature of the task. The gear task examined children's abilities to predict and

explain facilitating and inhibiting factors. Kassin (1981) suggested that this ability is rule-governed by a higher order principle than temporal contiguity and covariation. Perhaps temporal contiguity and covariation were the principles used in the temporal sequencing and displacement task, respectively, and the higher order principle was better able to discriminate between the older children's abilities. However, an alternate explanation would be that the larger number of items on the gears task, compared to the temporal and displacement tasks, provided for more variability among the scores.

For the total sample, the correlations between the indicators of cognitive style and children's understanding of safety and prevention supported the hypothesis that children with a reflective, compared to those with an impulsive, style have a more accurate understanding of safety and prevention. However when the age groups were separated, MFFT latency was not significantly related to safety score for either the younger or older groups, while the relationship between MFFT errors and safety remained significant. Although a larger correlation existed between MFFT errors compared to MFFT latency and the prevention score, for two regression analyses, MFFT latency entered before errors as a predictor. As with the measures of causal reasoning, this appears to be a function of the amount of variance the predictors shared with children's age. These results are consistent with other studies from which researchers have concluded that MFFT errors is a preferred predictor over MFFT latency (Egeland et al., 1980; Gjerde, Block, & Block, 1985; Haskins & McKinney, 1976; Victor, Halverson, & Montague, 1985).

Based on the MFFT scores of a longitudinally followed sample of

children at ages 3, 4, 5, and 11 years, Gjerde, Block, and Block (1985) questioned the reflection-impulsivity dimension as conceptualized by Kagan and his associates (1964). Because the error component of the MFFT scores was more consistent between the ages of 3 to 11 years than the latency component, these researchers suggested that the latency component has considerably less implications over time and questioned its use as an indicator of cognitive style. This finding on the consistency of MFFT scores coupled with the significant correlations found between children's performance on the MFFT and their Intelligence Test scores, were used in their argument that children's performance on the MFFT is more likely based on "competence" rather than "conceptual tempo". Significant relationships were evident in the current study between children's latency and error scores and their level of causal reasoning. Level of causal reasoning is an indicator of competence; however, it is not a stable characteristic for young children but one which evolves with cognitive development. During these early years, cognitive style and causal reasoning may have a reciprocal relationship (i.e., each cognitive characteristic influencing the development of the other). The relatively smaller magnitude of the correlations between cognitive style and level of causal reasoning for the older group suggest these two cognitive characteristics may become independent with development.

Victor, Halverson, and Montague's (1985) findings also support the notion that competency rather than response tempo may be the component of cognitive style that predicts children's performance. The data from their investigation indicated that preschoolers' response accuracy, on a matching task similar to the MFFT, was related to their impulsive

behavior while their response latency was not. They contended that even though a high negative correlation did not exist between their subjects' response errors and latency this should not make it inappropriate to view their findings in the reflection-impulsivity framework. A significant negative correlation was evident between MFFT errors and latency for the present study's sample of 3 to 5 year olds and 6 to 8 year olds; however, this does not necessarily provide support that it is a stable characteristic or a valid index of reflection-impulsivity for both age groups. Messer (1976) noted that preschoolers' delay in responding may be a result of their not understanding the task, rather than using this time to consider alternate hypotheses. In the current study, some of the 3 and 4 year olds appeared either to look away from the task for a length of time and then randomly select alternatives, or to respond quickly without examining the alternatives.

When children's performance on all the tasks was compared according to age in years, the means and standard deviations indicated that children's performance improves and becomes relatively more stable with an increase in age. This linear progression suggests that either the younger groups were more heterogeneous in ability than the older groups or they merely took less care in answering the questions regardless of abilities. Although both are possible explanations, theories on the development of causal reasoning (Piaget, 1960) and reflection-impulsivity (Kagan, et al., 1964; Messer, 1976) suggest a transitional nature of preschoolers' abilities. For the current sample, the magnitude of the correlations between the components of cognitive style, level of causal reasoning, and age were higher for the 3 to 5 year olds compared to the 6 to 8 year olds. The interrelations between

these characteristics indicate the developmental flux within the younger age group. The variability in the preschoolers' abilities explained more of the variance in their safety and prevention scores compared to the older children. This finding provides support for the possibility that proneness to accidents may be related to stage of psychological development, and not solely predicted by a stable personality type as suggested by earlier researchers. A longitudinal study of children during their preschool and school-age years that included the children's rate of accidents and measures of both their psychological development and personality type would provide a closer examination of this hypothesis.

Applied Implications

To the extent that children's responses do reflect an understanding of safety and accident prevention, the results from this study help clarify why preschoolers are more vulnerable to accidents than older children. The limitations inherent in younger children's causal reasoning and in their cognitive style place restrictions on their abilities to process information provided in the environment. Children's misunderstandings concerning the concepts of safety and prevention may increase the probability of their being in unsafe situations. Also once in these situations, the children may have difficulty recognizing measures for preventing injury.

Safety education programs targeted at the preschool age group might help effect a reduction in their rate of accidents. Yet to be effective, such programs would need to be appropriate for the cognitive capabilities of the children. The present results, indicating that children had higher safety than prevention scores and that these scores

were related to level of causal reasoning, suggest that the focus of programs be on prevention with the aim of encouraging the development of an understanding of cause-effect relationships in the environment. The concept of reversibility (Piaget, 1974) would be particularly relevant in helping children to understand how to transpose an unsafe situation into one which is safe. If safety education programs assume children can initially make and then reverse cause-effect connections, these programs might be either ineffective or confusing for those children who are limited in these abilities.

Direct involvement of children in identifying and analyzing critical features of the environment to make accident agent-injury causal connections and in seeing the effect of their own actions in preventing injury might reduce their accident proneness. Guided simulated experiences, through puppets or by video taping children in their own environment, might be particularly effective since this approach makes the abstract concepts of safety and accident prevention more concrete.

When children are involved in accident situations they are often told "it was an accident, no one meant to do this" perhaps as a way to reduce guilt or blame. However these comments do not assist children in identifying the cause-effect relationships present or in differentiating which elements of the environment are critical when calculating risk. Health and early childhood practitioners' recognition of children's level of causal reasoning and cognitive style should improve these professionals' quality of reassurance and transform the realities of the accident situation into a learning experience.

Measurement Issues

Level of causal reasoning may have been the preferred predictor over cognitive style because the tasks used to measure causal reasoning were more appropriate discriminators of children's abilities. However, the reflection-impulsivity dimension is concerned with children's solution hypotheses in problems that contain response uncertainty (Kagan & Kogan, 1970). Because so many of the older children had a perfect score on the safety measure, the uncertainty issue of this task for the older group could be questioned. The possibility still exists that cognitive style is related to understanding of safety in situations that are less clear cut than those depicted in the photographs used in this study.

Another explanation for why causal reasoning was the preferred predictor of children's performance on the criterion measures may be the similarity of the causal reasoning tasks and the cause-effect connections between accident agent and injury tested in the safety and prevention tasks. The safety measure in particular may have been a specific type of causal reasoning task. Nicholls, Licht, and Pearl (1982) presented the problem that overlapping content within two separate self-report measures can result in spurious inflation of associations between presumably separate constructs. However, they indicated a dilemma exists in that removal of this overlap of content may result in less valid scales if essential aspects of the constructs are deleted. In response, Hogan, Hogan, Briggs, and Jones (1983) argued that constructs are broad and multifaceted and might be better referred to as syndromes. These latter authors suggested the issue is not the dilemma of similar content but knowing what should be included in the

syndrome. The possibility that associations between safety and causal reasoning scores were inflated in the current study could be investigated in future research in which aspects other than ability to make causal connections are incorporated in a measure of safety. In other words, future research might be directed toward defining a "safety syndrome". Additionally the association between level of cognitive development and an understanding of safety could be examined by including measures of cognitive development other than causal reasoning tasks. A conservation task would differentiate between children's abilities to focus on more than one aspect of the stimulus array without specifically requesting a causal connection.

Although it may well be the case that the tasks used in the present study did not tap the full domain of safety and accident prevention constructs, the photographs used did allow aspects of the stimulus situations (i.e., children, accident agents, and physical environments) to be consistent for all subjects. These photographs might be effective in teaching safety and as a screening tool for determining children at risk for accidents. The reliability and validity of the photographs for use as a teaching and a screening tool need to be investigated. The effectiveness of video-tapes should also be explored. The video-tapes would remove the limitations of perceiving a still environment while continuing to provide consistency across subjects. Tasks utilizing the tapes should provide a more challenging task for school-age children by providing extended sequences containing more than one cause-effect relationship. The abilities to integrate two or more relationships and to establish a reversible series of events through logical deductions is characteristic of children with an understanding of causality (Kassin,

1981; Piaget, 1960, 1974).

In addition to the measurement issues related to the child variables, those related to the parent variables also need to be considered. The nonsignificant relationships between the parental measures and children's understanding of safety and accident prevention may have been a function of the poor return rate for the parent questionnaire and/or a function of parent's self-report being influenced by social desirability. Further refinement of the research questions, revisions in the parent questionnaire, and efforts to increase parents' participation in future studies may reveal significant relationships between the variables. For example, the response style questionnaire could be revised so that the parents would rank the response style categories identified in the present study according to the likelihood of their using them in response to children in unsafe situations. This change plus personal contact with the parents through a telephone conversation might improve the return rate for the questionnaire.

Limitations

Despite strong evidence both from this study and the previous research (Coppens, 1985) that level of causal reasoning is related to children's understanding of safety and prevention, several limitations on the present findings should be emphasized. It must be stressed that the correlational nature of the present study precludes making causal links between the variables investigated. There has also been a lack of confirmation of these findings by other researchers. A longitudinal examination of children's frequency of accidents, cognitive characteristics, understanding of the concepts of safety and accident prevention, and interactions with significant others would clarify the

relationship among these variables. Repeated assessments over time would provide data on the validity of children's safety and prevention scores in predicting the frequency of their involvement in accidents.

There are limitations in generalizing the results of the current study to other age groups and unsafe situations in which injury is neither foreseeable nor preventable. In light of the developmental nature of causal reasoning skills, the preferred method for measuring those skills and their relation to an understanding of safety and prevention may differ for children younger and older than the sample in this study. Children's understanding of the concepts of safety and accident prevention were based on their perceptions of preventable unsafe situations. Even though most unsafe situations are preventable (International Children's Centre, 1979), it is possible that children's level of casual reasoning and cognitive style are not related to an understanding of unforeseeable unsafe situations.

Since 78% of the mothers and 100% of the fathers returning the questionnaire reported full-time employment outside the home, the parents' responses may not be typical of families with different employment status. Because all of the children were enrolled in preschool daycare or after-school programs, the results may not be generalizable to those children who are not. For children enrolled in such programs, teachers may have an influence on their understanding the concepts of safety and prevention.

Directions for Future Research

Walters and Walters' (1980) review of parent-child issues emphasized the need to examine causality from the perspective of reciprocity. Viewing the family as a system in which each member

influences and is influenced by other members necessitates an interactional approach (Lerner & Spanier, 1978; Lytton, 1980). Family size and ordinal position of children (e.g., oldest vs youngest) might have an effect not only on the family dynamics, but also the degree of safety practiced within the home. Greater attention should be paid to the ecological context of children's interactions, not only with other people, but with their physical environment as well. Behavior ratings of children's interactions with family and peers in naturalistic settings (e.g., home and playgrounds) should provide a clearer picture of the influence others have on children's understanding of safety and accident prevention and on the occurrence of children's accidents.

Belsky's (1984) model presumes that parental functioning is multi-determined by feedback between personal psychological resources of parents, characteristics of the child, and contextual sources of stress and support. The Determinants of Children's Development questionnaire used in the present study may not have tapped parents' psychological resources or underlying theories. A more dynamic, comprehensive measure may be needed to detect these resources. Belsky's feedback model could also be applied to children to help explain individual differences in their functioning as it relates to issues of safety. An example of children's psychological resources are the cognitive characteristics examined in the present study. Characteristics of parents or significant others would represent the second component. The stress and support components may be related to the findings of earlier research on children's accidents (Marcus et al., 1960; Meyer et al., 1963).

Incorporating additional predictor and criterion measures in future studies might help explain statistical differences in rate of children's

accidents not examined in the current study. For example, although a sex difference was not present in children's understanding of safety and accident prevention, statistically boys have a higher rate of accidents than girls (International Children's Centre, 1979; Matheny et al., 1971; Ruuhilehto-Saari, 1982). Research by Ginsburg and Miller (1982) indicated that although more 3 to 11 year old boys than girls engaged in risk taking behavior, both older boys and girls were more likely to take risks than their younger counterparts. The extent to which children expose themselves to unsafe situations may be related to their frequency of accidents. Future studies which examine age-related differences in children's accident proneness could include not only differences in children's psychological characteristics but also the extent to which the children expose themselves to risk. Such an approach was used by Manheimer and Mellinger (1967) in examining high, intermediate, and low accident liability groups; however, they did not consider the possibility that rate of exposure to unsafe situations may be a preferred predictor for school-age children's involvement in accidents, while psychological characteristics which evolve with development (e.g., causal reasoning) may better predict preschoolers' involvement in accidents.

In conclusion, to provide a clearer picture of child-accident phenomena, researchers need to consider children's psychological resources which vary as a function of development as well as those which persist over time. A longitudinal approach, which examines the progressive interactions of children within their environment, might detect influencing characteristics of others and the contextual effects of stress and support on children's understanding of safety and

prevention and their accident proneness. Knowledge gained from this research would guide parents, health professionals, and educators in the identification of characteristics which place individuals and groups at risk for accidents. This information would also provide added direction for educational programs geared to reducing the vulnerability of children to accidents.

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APPENDICES

APPENDIX A. PARENT LETTER

Dear Parents,

This letter is to let you know about a project which I will be doing at your child's school. This project is part of the graduate work I am doing in developmental psychology at the University of New Hampshire. Having worked as a Registered Nurse in Pediatrics and also being a parent of 4 and 7 year old children, I have a particular interest in why preschoolers are more likely to have accidents than school age children. This project will look at differences in children's understanding of safety and prevention.

If you and your child would like to be included in this study, your child will be interviewed while he/she is at school. Your child will be asked to identify safe and unsafe features represented in a set of photographs and to do some problem solving tasks. These photographs have already been used with preschool children and they have provided a medium for learning about safety and prevention. Parental participation will involve your completing a questionnaire which will be sent to you. This questionnaire consists of questions pertaining to your beliefs concerning children's development. There are also descriptions of situations in which you are asked to write what your response would be if your child were in these situations. There are no right or wrong answers to these questions. It will take you approximately 20 minutes to complete the questionnaire. One of the issues I am interested in is whether there are differences between mothers' and fathers' responses to their child. Thus if both parents are present in the home, I would greatly appreciate it if you both complete a questionnaire. Single parent families are also encouraged to participate.

At the time of your child's interview he/she will be given a lesson on safety and accident prevention, and a small gift as a thank you for participating in the study. After all information has been collected you will be sent a summary of the results. Only group data will be analyzed. Responses of individuals will be kept confidential, and responses will be referred to only by code number, never by name.

If you would like to participate, please complete the enclosed consent form and return it to the box marked "safety study" which is located next to the sign out sheet at your child's school. I believe this study will provide beneficial information on how we might increase children's ability to identify and prevent unsafe situations. Thank you for your involvement if you choose to participate. If you have any questions, please call me at 882-7325.

Sincerely,

Nina Coppens

Nina Coppens

APPENDIX B, CONSENT FORM

1. We understand that the safety study has been approved by the University of New Hampshire Institutional Review Board.
2. We understand the purpose of this research project, the procedures to be followed and the expected duration of our participation.
3. We have received a description of potential benefits from this research.
4. We understand that the confidentiality of all records associated with our participation in this research, including our identity, will be fully maintained within the extent of the law.
5. We understand that we have the right to ask any questions concerning this research and our participation in it and to have such questions answered by the investigator, Nina Coppens, who can be reached at 882-7325.
6. We understand that our consent to participate in this research is entirely voluntary.
7. We understand that if we consent to participate, we may discontinue participation at any time without penalty.
8. We understand that our child will be interviewed only if he/she approves.
9. We confirm that no coercion was used in seeking our participation in this research project.
10. We understand that any information gained as a result of our participation will be provided to us as group results at the conclusion of this research project.

We _____ and _____ agree to participate in this
 (name of mother) (name of father)
 research project and agree that our child _____, can
 participate in this research project. (name of child)

We _____ and _____ do not agree to participate in
 (name of mother) (name of father)
 this research project and do not agree that our child _____,
 can participate in this research project. (name of child)

 (signature of child's mother, today's date)

 (signature of child's father, today's date)

If you are a single parent, only your signature is necessary.

APPENDIX C. WORKSHEETS FOR SCORING CHILDREN'S RESPONSES

Child's code number_____. Date_____. Time_____.

TEMPORAL ORDERING OF EVENTS TASK

Show the child two sets of three stage picture sequence cards (one set at a time), a blank card with an X on it, and the slant board on which the cards are placed. Tell the child that together the pictures are about a story. Place the first and second cards in the series from the first set on the board with the X card after the second card. Now place the third card in the series on the X card. Tell the child that this card comes next, it finishes the story. Describe what is happening in the story. Repeat with the second set of cards except place second and third card on the board with X card before the second card and have child place the first card on the X card. Tell the child that this card comes before the others and it begins the story. Describe what is happening in the story.

Part 1

4 sets of five step sequence cards are shown one set at a time. The same child and activity within each set, but different children and activities across sets.

For two sets the third and fourth pictures of the sequence are on the display board with the blank X card after the fourth picture. The child is asked to look at the remaining three cards and place the card that comes next on the X card.

For two sets the second and third pictures are on the display board with the blank card before the second picture. The child is asked to look at the three remaining cards and place the card that comes before on the X card.

Request for first____, last____ Girl in tunnel. position selected____

Request for first____, last____ Boy with beads. position selected____

Request for first____, last____ Boy on slide. position selected____

Request for first____, last____ Girl and blocks. position selected____

Part 1 total points_____

Temporal Ordering of events task.

Part 2

Procedure in Part 1 is continued except now four sets of five sequence cards are shown together at one time. The same girl is depicted in two of the sets and the same boy in the other two sets. But there are different activities across sets.

Request for first___, last___ Girl brushing teeth. position selected___
same set yes___ no___

Request for first___, last___ Girl doing puzzle. position selected___
same set yes___ no___

Request for first___, last___ Boy eating ice cream position selected___
same set yes___ no___

Request for first___, last___ Boy washing hands. position selected___
same set yes___ no___

Part 2 total points___

Part 3

Procedure in Part 2 is continued. The same adult and activity are depicted within each set of five photographs, but different adults (woman same, but blouse different) and activities across sets.

Request for first___, last___ man getting milk. position selected___
same set yes___ no___

Request for first___, last___ woman with phone. position selected___
same set yes___ no___

Request for first___, last___ woman with toaster. position selected___
same set yes___ no___

Request for first___, last___ man with eggs. position selected___
same set yes___ no___

Part 3 total points _____

Total all three parts _____

DISPLACEMENT OF WATER TASK

Child is shown a clear glass 1/2 full of water (the level of water is marked in red on the outside of the glass), a small rock, and a large rock. Small rock is made of lead so it is heavier than large rock. Size and weight of rocks are not verbalized to the child.

PART 1:

Child is handed the larger rock and told to look at it.

Ask child to touch the glass where the water level will be after this rock is put in the water.

Predictions: above line*_____, below line_____, on line_____.
(if unsure of where pointing ask child if above, below, or on line)

Then ask child why the level of water would be there.

Explanation: size important (big rock takes up space) _____, rock weight important (heavy) _____, other_____, nonsense answer _____.

Have child put larger rock in the water, then mark the second water level blue.

PART 2:

Remove larger rock. Child is handed the small (but heavier) rock and told to look at it. Ask child to touch the glass where the water level will be after this rock is put in the water.

Predictions: above red (first) line. yes*_____, no_____.
below blue (second) line. yes*_____, no_____.
(if unsure where pointing ask child if above or below lines)

Then ask child why the level of water would be there.

Explanation: size and not weight important _____.
size of rock is important _____.
weight of rock is what makes water go up _____.
other_____, nonsense answer_____.

Summary of child's explanations concerning change in water levels.

no mention of the rocks' weight or size _____.
mentions rocks' weight only _____.
mentions importance of rocks' weight and size _____.
mentions size not weight important _____.

After testing ask child:

Ask child which rock is larger in size: correct_____,incorrect_____.

Ask child which rock is heavier: correct_____,incorrect_____.

GEAR MOVEMENT TASK

A sample gear with a crank on it is shown to the child. Child is then shown how it can turn around by moving the crank.

Child is ask if he/she has seen this toy before: yes____, no____.

Child is shown a complex sequence of gears designed in the form of a "T".

On one side there exists two areas where gears are not inter-locked and the gear movement will not continue to the end. On the other side the gears are continuous and the movement will continue to the end.

Animals or people are located on the second to last gear on each end. Their movement or lack of movement is the effect of interest. Position of animals and people will be alternated across testing sessions.
* answers are correct and worth one point.

PART 1

(a) Child is asked: when the crank is turned at the base (point to), what will happen to the animals (point to, located on continuous end)?

Prediction: mentions turn around*____, not turn around____, nonsense____

Child is asked why they think that will happen?

Explanation: gears joined*_____, other gear related answer____,
nonsense_____.

(b) Child is asked: when the crank is turned at the base (point to), what will happen to the people (point to, located on noncontinuous end)?

Prediction: mentions turn around____, not turn around*____, nonsense____

Child is asked why they think that will happen?

Explanation: one area where gears not interlocked*_____.
second area where gears not interlocked*_____.
other gear related answer_____. nonsense_____.

Total prediction _____ Total explanation_____ Combined score_____

Gear Movement Task:

Gear movement is demonstrated to the child by turning the crank at the base.

PART 2: Relevant and irrelevant parts of the gear display are taken away one at a time.

Tell the child that some things are going to be taken away. After each is taken away, ask the child when the crank is turned at the base, what will happen to the animals? Then ask child why that would happen? The part is replaced before another one is removed.

When the crank is turned, what will happen to the animals?

| | |
|---------------------------------|----------------------------------|
| remove necessary gear on side | remove gear past animals |
| move___ not move*___ nonsense__ | move*___ not move___ nonsense___ |
| WHY? correct: yes___ no_____. | WHY? correct: yes___ no_____. |

| | |
|---------------------------------|----------------------------------|
| remove necessary gear at base | remove round peg |
| move___ not move*___ nonsense__ | move*___ not move___ nonsense___ |
| WHY? correct: yes___ no_____. | WHY? correct: yes___ no_____. |

Prediction score____. Explanation score____. Combined score_____

PART 3

Relevant and irrelevant parts are added one at a time to the display.

Tell the child that some things are going to be added. After each is added ask the child: when the crank is turned at the base, (a) what will happen to the animals, or (b) what will happen to the people. Then ask why? The part is removed before another one is added.

(a) When the crank is turned, what will happen to the animals?

ADD to the animal side of display:

peg in gear spoke past animals move___ not move*___ nonsense___
WHY? correct yes__ no__

round peg on gear move*___ not move___nonsense__ WHY?correct yes___ no__

peg on base away from gears.move*__ not move___nonsense__WHY? yes__ no__

(b) When the crank is turned, what will happen to the people?

ADD to the people side of the display:

an animal: move___, not move*___,nonsense___ WHY? correct: yes___ no___

a gear to join one of the spaces move___not move*___,nonsense___
(leave this gear on the display) WHY? yes___ no___

a second gear to join the remaining space on the people side.
move*_____, not move_____,nonsense____. WHY? correct: yes____, no____

Prediction score____, Explanation score____, Combined score_____.

MATCHING FAMILIAR FIGURES TASK

The test booklet is placed on a display stand so that the stimulus and alternatives are clearly visible to the child at the same time. The two pages are at right angles to one another. Say to the child, "I am going to show you a picture of something and then some pictures that look like it. You will have to point to the picture on this bottom page (point) that is just like the one on this top page (point). Let's do some for practice." The practice items are shown and the child is helped to find the correct answer.

Say to the child, "Now we are going to do some that are a little bit harder. You will see a picture on top and six pictures on the bottom. Find the one that is just like the one on top and point to it." Record latency to first response to the half-second and total number of errors for each item. Code responses until child makes a maximum of six errors or gets the item correct. If incorrect after six responses, show right answer. If child is correct, praise him or her. If incorrect, say "No, that is not the right one. Find the one that is just like this one (point)".

| Item (Correct) | Time to first response | selections | # errors |
|---------------------|------------------------|--------------|----------|
| 1. House (1) | ----- | ----- | ----- |
| 2. Scissors (6) | ----- | ----- | ----- |
| 3. Phone (3) | ----- | ----- | ----- |
| 4. Bear (1) | ----- | ----- | ----- |
| 5. Tree (2) | ----- | ----- | ----- |
| 6. Leaf (6) | ----- | ----- | ----- |
| 7. Cat (3) | ----- | ----- | ----- |
| 8. Dress (5) | ----- | ----- | ----- |
| 9. Giraffe (4) | ----- | ----- | ----- |
| 10. Lamp (5) | ----- | ----- | ----- |
| 11. Boat (2) | ----- | ----- | ----- |
| 12. Cowboy (4) | ----- | ----- | ----- |
| Total Response time | ----- | Total errors | ----- |

looked at standard and variants for first choice only____
 looked at standard and variants for some choices____
 looked at standard and variants for each choice____
 did not compare variants with standard____

DIFFERENTIATION OF SAFE AND UNSAFE SITUATIONS TASK

Initially for half ask to point to safe picture. For second half, ask to point to unsafe picture (Randomize)

After the selection is made, child ask why he/she picked that picture. Questioned to determine if he/she can describe a cause (facilitatory or inhibitory) and the potential injury in the unsafe situation.

MOTHER DRIVING: CHILD LEANING ON DASH BOARD/ WEARING SEAT BELT.

Request for safe___,unsafe___. Correct___, Incorrect___.

WHY? Described cause: yes___,no___. Described injury: yes___,no___.

CHILD AT BEACH: PLAYING WITH PILLS/ EATING CHEESE.

Request for safe___,unsafe___. Correct___, Incorrect___.

WHY? Described cause: yes___,no___. Described injury: yes___,no___.

CHILD SITTING NEAR, WHILE LAWN BEING MOWED/TWO CHILDREN PLAYING BALL

Request for safe___,unsafe___. Correct___, Incorrect___.

WHY? Described cause: yes___,no___. Described injury: yes___,no___.

FATHER LOOKING ELSEWHERE: CHILD STANDING IN SHOPPING CART/SITTING.

Request for safe___,unsafe___. Correct___, Incorrect___.

WHY? Described cause: yes___,no___. Described injury: yes___,no___.

CHILD STEPPING IN FRONT OF CAR/ HOLDING MOTHER'S HAND, LOOKING.

Request for safe___,unsafe___. Correct___, Incorrect___.

WHY? Described cause: yes___,no___. Described injury: yes___,no___.

CHILD LEANING OUT SECOND FLOOR WINDOW/ SCREEN DOWN, INSIDE.

Request for safe___,unsafe___. Correct___, Incorrect___.

WHY? Described cause: yes___,no___. Described injury: yes___,no___.

CHILD PLAYING WITH MATCHES/ PUTTING TOOTHPASTE ON BRUSH.

Request for safe___,unsafe___. Correct___, Incorrect___.

WHY? Described cause: yes___,no___. Described injury: yes___,no___.

CHILD REACHING FOR PAN ON FRONT BURNER OF STOVE/ STANDING BACK.

Request for safe___,unsafe___. Correct___, Incorrect___.

WHY? Described cause: yes___,no___. Described injury: yes___,no___.

CHILD SITTING ON RAILING OF DECK/ SITTING ON CHAIR ON DECK.

Request for safe___,unsafe___. Correct___, Incorrect___.

WHY? Described cause: yes___,no___. Described injury: yes___,no___.

CHILD REACHING FOR CANDLE'S FLAME/ HOLDING FLASHLIGHT.

Request for safe___,unsafe___. Correct___, Incorrect___.

WHY? Described cause: yes___,no___. Described injury: yes___,no___.

SKATE ON STAIRS, NOT HOLDING RAILING/ NO SKATE, HOLDING RAILING.

Request for safe___,unsafe___. Correct___, Incorrect___.

WHY? Described cause: yes___,no___. Described injury: yes___,no___.

Total selection_____. Total Cause_____. Total Injury_____.

SPECIFICATION OF PREVENTIVE MEASURES TASK.

Tell the child that the pictures he/she will now be seeing are of children doing something that is not safe. Because what the children are doing is not safe, they could get hurt.

Show the child the pictures one at a time (random order) and ask:

1. What could be done so the child in the picture would be safe?
2. What could the child in the picture do so he/she would be safe?
3. What could you do so the child in the picture would be safe?
4. What could somebody else do so the child in the picture would be safe?
5. Can you think of anything else that could be done so the child would be safe?

Number 5 scored correct only if different from previous answers.

If response same across questions, probe for different responses (What else could the child do, etc).

CHILD PULLING ON IRON'S CORD.

- 1.
- 2.
- 3.
- 4.
- 5.

CHILD LOOKING UNDER WORKBENCH (ELECTRIC SAW, POISONS, ETC).

- 1.
- 2.
- 3.
- 4.
- 5.

CHILD STANDING ON CHAIR REACHING FOR MEDICINE.

- 1.
- 2.
- 3.
- 4.
- 5.

CHILD STANDING ON A SELF IN A GROCERY STORE.

- 1.
- 2.
- 3.
- 4.
- 5.

CHILD TOUCHING BLADES ON A FAN.

- 1.
- 2.
- 3.
- 4.
- 5.

Total Score_____.

APPENDIX D, PARENT QUESTIONNAIRE

This questionnaire is to be completed by either circling a number, placing a check mark in the space, or writing a response. No names will be associated with this information. Your responses will be used to see if these factors influence children's understanding of safety and accident prevention. While completing the questionnaire please do not discuss your answers with anyone until you are finished. Thank you for your time!

Your marital status:

1. married
2. single
3. divorced/separated

Your child in the study lives with:

1. Mother only
2. Father only
3. Both Mother and Father
4. other_____.

Child's birthdate_____.

Child's sex: female____, male_____.

Number of children in your home_____.

Ages of children_____.

Your highest educational level:

1. elementary school graduate
2. some high school
3. high school graduate
4. some college
5. technical school graduate
6. college graduate
7. advanced degree_____ (specify)

Your occupation:_____.

Are you employed outside the home?
no____, part-time____, full-time_____.

How much time would you estimate
you spend talking with your child
in an average day?_____.

At what age do you think children
can identify cause and effect
relationships (one action causes
another action or event)?_____.

Compared to the average child
how would you describe your child's
proneness to have accidents?

The approximate annual income
level of your family:

1. under \$5,000
2. \$5,000 to \$9,999
3. \$10,000 to \$14,999
4. \$15,000 to \$19,999
5. \$20,000 to \$24,999
6. \$25,000 to \$29,999
7. \$30,000 to \$34,999
8. \$35,000 to \$39,999
9. \$40,000 to \$44,999
10. over \$45,000

Your age_____.

How often do you wear an
automobile seat belt?

1. never
2. sometimes
3. always

How often does your child
wear an automobile seat belt?

1. never
2. sometimes
3. always

Do you have a smoke detector
in your home? yes____, no_____.

Traffic next to your home is:

1. not busy
2. somewhat busy
3. very busy

At what age do you think a
child knows right from wrong?
_____.

How do you think a child
develops an understanding
of safety and accident
prevention?

DETERMINANTS OF CHILDREN'S DEVELOPMENT QUESTIONNAIRE

For each of the following statements, circle the number which most closely corresponds to your belief on whether the characteristic described in the statement occurs because of environment, heredity, or some combination of both heredity and environment.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | | | |
|---|---|---|---|--|---|---|--|---|---|---|---|
| | Only Heredity (genes, inborn traits) | | | equal Combination of Heredity and Environment | | | Only Environment (surroundings, treatment by others) | | | | |
| 1. Children's intelligence (IQ) occurs because of: | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. Children develop language because of: | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. Children within the same family may have different personalities because of: | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. Children of the same age may act differently because of: | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. Some children may be more prone to accidents than other children because of: | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Children's skills at performing physical tasks improve with age because of: | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. If there are differences in boys' and girls' abilities, this difference occurs because of: | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. Some children may be more aggressive than other children because of: | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Has your child ever had an accident for which he/she needed to see a doctor (a cut, a fall, a burn, eating too many pills, etc.)?

yes____, no____.

If yes, please describe the situation(s), injury(s), and child's age.

PARENTS' STYLE OF RESPONDING QUESTIONNAIRE

When you are reading the following situations, think of the child in the situation as your child who is participating in this study. After reading the situation, write: (a) what your entire response would be if this was the FIRST time you saw your child do the described action, and (b) what your response would be if this was the SECOND time you had seen your child do this action. Your response to (a) may be the same or different than your response in (b).

1. You walk into the bathroom and see your child counting pills from a bottle of your medicine.

(a) If this is the first time I've seen my child do this,
my response would be:

(b) If this is the second time I've seen my child do this,
my response would be:

2. You are outside talking with a neighbor when you see your child run into the street to get a ball. The child did not look for oncoming cars.

(a) If this is the first time I've seen my child do this,
my response would be:

(b) If this is the second time I've seen my child do this,
my response would be:

3. Your child has plugged a fan, with the switch turned off, into an outlet. The child is now trying to make the blades go around by moving them with his/her finger.
 - (a) If this is the first time I've seen my child do this, my response would be:

 - (b) If this is the second time I've seen my child do this, my response would be:

4. You have found out that your child has told you a lie.
 - (a) If this is the first time I knew my child had lied, my response would be:

 - (b) If this is the second time I knew my child had lied, my response would be:

5. As your child walks down the stairs holding onto the hand rail, he/she picks up a roller skate left on the step to avoid tripping on it.
 - (a) If this is the first time I've seen my child do this, my response would be:

 - (b) If this is the second time I've seen my child do this, my response would be:

6. You see your child trying to get the iron off of a high shelf by pulling on the cord.

(a) If this is the first time I've seen my child do this, my response would be:

(b) If this is the second time I've seen my child do this, my response would be:

7. Your child was playing with leaves when he/she found some matches and decided to start a camp fire. You see smoke coming out of the leaves.

(a) If this is the first time I've seen my child do this, my response would be:

(b) If this is the second time I've seen my child do this, my response would be:

8. Your child and his/her friend are arguing loudly over which program they will watch on television.

(a) If this is the first time I've seen my child do this, my response would be:

(b) If this is the second time I've seen my child do this, my response would be:

APPENDIX E, FREQUENCY (%) OF PARENTS' RESPONSE CATEGORIES

| Mothers' Response Categories | Time | Situations | | | | |
|---------------------------------|----------|------------|---------|---------|---------|---------|
| | Observed | Pills | Street | Fan | Iron | Fire |
| Behavioral Conformity | First | 3(5%) | 9(14%) | 5(8%) | 4(6%) | 2(3%) |
| | Second | 3(5%) | 5(8%) | 4(6%) | 3(5%) | 3(5%) |
| Physical Punishment | First | 0(0%) | 1(2%) | 3(5%) | 0(0%) | 5(8%) |
| | Second | 4(6%) | 8(13%) | 13(21%) | 8(13%) | 13(21%) |
| Verbal Punishment | First | 8(13%) | 21(33%) | 7(11%) | 11(17%) | 10(16%) |
| | Second | 10(16%) | 13(21%) | 6(10%) | 10(16%) | 6(10%) |
| Discipline | First | 1(2%) | 4(6%) | 0(0%) | 0(0%) | 1(2%) |
| | Second | 10(16%) | 21(33%) | 5(8%) | 9(14%) | 17(27%) |
| Remove Accident Agent | First | 18(29%) | 1(2%) | 11(17%) | 7(11%) | 20(32%) |
| | Second | 17(27%) | 1(2%) | 15(24%) | 5(8%) | 3(5%) |
| Consequential Thinking | First | 16(25%) | 23(37%) | 36(57%) | 38(60%) | 23(37%) |
| | Second | 11(17%) | 13(21%) | 15(24%) | 26(41%) | 18(29%) |
| Questioning | First | 16(25%) | 2(3%) | 0(0%) | 3(5%) | 2(3%) |
| | Second | 4(6%) | 1(2%) | 1(2%) | 2(3%) | 2(3%) |
| Tells Status of Sit. | First | 1(2%) | 2(3%) | 1(2%) | 0(0%) | 0(0%) |
| | Second | 3(5%) | 1(2%) | 2(3%) | 0(0%) | 0(0%) |
| No Action or Response | First | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 0(0%) |
| | Second | 1(2%) | 0(0%) | 2(3%) | 0(0%) | 1(2%) |

| Fathers' Response Categories | Time Observed | Situations | | | | |
|------------------------------|---------------|------------|---------|---------|---------|---------|
| | | Pills | Street | Fan | Iron | Fire |
| Behavioral Conformity | First | 4(11%) | 6(16%) | 3(8%) | 3(9%) | 3(9%) |
| | Second | 3(8%) | 4(11%) | 1(3%) | 2(6%) | 1(3%) |
| Physical Punishment | First | 0(0%) | 1(3%) | 4(11%) | 0(0%) | 2(6%) |
| | Second | 7(19%) | 8(22%) | 8(22%) | 3(9%) | 6(17%) |
| Verbal Punishment | First | 12(32%) | 12(32%) | 3(8%) | 7(21%) | 8(23%) |
| | Second | 10(27%) | 5(14%) | 6(17%) | 11(32%) | 6(17%) |
| Discipline | First | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 3(9%) |
| | Second | 4(11%) | 12(32%) | 6(17%) | 5(15%) | 13(37%) |
| Remove Accident Agent | First | 3(8%) | 0(0%) | 3(8%) | 3(9%) | 11(31%) |
| | Second | 5(14%) | 0(0%) | 2(6%) | 3(9%) | 4(11%) |
| Consequential Thinking | First | 11(30%) | 17(46%) | 21(58%) | 18(53%) | 7(20%) |
| | Second | 5(14%) | 8(22%) | 12(33%) | 8(24%) | 4(11%) |
| Questioning | First | 4(11%) | 0(0%) | 0(0%) | 1(3%) | 0(0%) |
| | Second | 3(8%) | 0(0%) | 0(0%) | 0(0%) | 1(3%) |
| Tells Status of Sit. | First | 3(8%) | 1(3%) | 2(6%) | 2(6%) | 1(3%) |
| | Second | 0(0%) | 0(0%) | 1(3%) | 1(3%) | 0(0%) |
| No Action or Response | First | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 0(0%) |
| | Second | 0(0%) | 0(0%) | 0(0%) | 1(3%) | 0(0%) |

APPENDIX F. CORRELATIONS WITH PERFECT SAFETY SCORES OMITTED

Predictors-----Criteria: Safety--

Total Group ($n = 76$)

| | |
|-------------------|--------|
| Age | .67** |
| Causal Reasoning: | |
| Gears | .66** |
| Displacement | .56** |
| Temporal | .69** |
| Cognitive Style: | |
| Latency | .40** |
| Errors | -.52** |

3, 4 and 5 year olds ($n = 53$)

| | |
|-------------------|--------|
| Age | .65** |
| Causal Reasoning: | |
| Gears | .69** |
| Displacement | .51** |
| Temporal | .62** |
| Cognitive Style: | |
| Latency | .21 |
| Errors | -.37** |

6, 7 and 8 year olds ($n = 23$)

| | |
|-------------------|-----|
| Age | .34 |
| Causal Reasoning: | |
| Gears | .27 |
| Displacement | .09 |
| Temporal | .31 |
| Cognitive Style: | |
| Latency | .11 |
| Errors | .01 |

** $p < .01$

APPENDIX G, MEAN PERFORMANCE (STANDARD DEVIATION) ON THE
INDIVIDUAL PREVENTION QUESTIONS

| Question | Age | | |
|--|-------------------|------------------|------------------|
| | 3 to 8 N = 112 | 3 to 5 n = 55 | 6 to 8 n = 57 |
| 1. What could be done so the child in the picture would be safe? | 3.5(1.9) | 2.4(2.0) | 4.6(.7) |
| 2. What could the child in the picture do so he/she would be safe? | 3.2(1.9) | 2.1(1.9) | 4.2(1.1) |
| 3. What could you do so the child in the picture would be safe? | 3.1(2.0) | 1.9(1.9) | 4.1(1.2) |
| 4. What could somebody else do so the child in the picture would be safe? | 3.3(1.7) | 2.4(1.7) | 4.2(1.1) |
| 5. Can you think of anything else that could be done so the child would be safe? | .9(1.3) | .2(.5) | 1.5(1.4) |